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Cover Photograph: A college flock *Photo: Geoff. Charles*

(Draft Welsh mountain ewes and Suffolk cross lambs on the University College Farm, Bangor.)

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Grazing is an Art

ANDRÉ VOISIN

Member of l'Académie d'Agriculture de France

In M. Voisin's opinion, there is too little understanding of the art of pasture grazing—in particular, the need of rest periods for grass.

GRAZING, in my view, is much more of an art than a science. This art has always been known to the shepherds who, as long as six thousand years ago, were practising strip-grazing on the plateaux of Iran and Palestine, using that wonderful living electric fence—the dog, a "fence" which can be moved about much more easily and quickly than any ultra-modern type of electric fence.

Similarly, shepherds have always respected the rules of rational grazing which best satisfy the requirements both of the grass and of the animals; the shepherd took care not to put his flock on to grass which was too *young*, or too *old*. He knew that if he broke this rule the yield of grass would be very poor; also that he would be feeding his animals on pasture of low food value. It could in fact even be harmful to their health—in particular, if they were running exclusively on very young grass.

Present ideas challenged

I have often wondered if our grazing methods have really made any progress, in comparison with those of the shepherds of the Medes, Assyrians, or Hittites. At the risk of shocking my readers, I shall admit that not only do I not believe that our methods have advanced, but rather that I feel they have even retrogressed.

The enclosure of pastures has led to the policy of continuous grazing, which means putting the animals to graze on a pasture at the beginning of the season and leaving them there until the end of the season. The animal crops mercilessly and unrestrainedly at the young grass as soon as it has grown again or else leaves it to grow as tough as wood in the patches he does not care to touch. The shepherd has abdicated and has handed over his responsibility to the animal, which is now free to do as it wishes.

In all countries, the centres of grassland research have scarcely studied methods of grazing at all; one might go so far as to say that they have seriously neglected them. There is much talk about "grassland management", but very little about "grazing management".

Great efforts have been devoted to the improvement of the grasses of our pastures. It is no exaggeration to say that 90 per cent of the money given for research, of the reports published and of general propaganda on the subject, is devoted to research of this kind and to the use of new varieties of pasture plants. From the viewpoint of botany and plant genetics, we are bound to acknowledge the great value of the study undertaken and of the selections obtained.

Nevertheless, these efforts, however admirable they may be from the

strictly botanical point of view, have not brought the practical results which might have been expected. The new selections of pasture plants have sometimes even caused much harm, because the animal's point of view has been ignored. More precisely, it has been assumed that chemical analysis enabled us to ascertain the "animal value" of a plant. However, it has not succeeded in replacing the biological test (that is, the animal) or in enabling us to judge the quality of the new selected varieties. We have been forced to admit that certain varieties of *dactylis* were not readily eaten by the animals and that certain white clovers had a strong tendency to cause bloat.

I remember a remark made by Professor Cooper of Durham University: "The plant which seems ideal to the chemist is not necessarily ideal for the animal."

The English Nobel Prize winner Synge, of the Rowett Institute, once wrote: "It would certainly be highly presumptuous to go so far as to advise a farmer to base the fodder ration of his cows on an analysis of the nitrogen content of the fodder."

This neglect of the animal by the botanists has certainly had, and continues to have, serious consequences for the health of our animals and upon their yields.

Pasture flora and grazing management

Our neglect of methods of grazing management has likewise made itself felt on the plants themselves; the ecology of pastures has been considered too much from the static point of view, as though the flora of a pasture were almost exclusively a function of the soil and the climatic conditions. And yet in England Martin Jones did excellent work in showing to what extent the flora of a pasture depend on the methods of grazing management; good management can turn an old, deteriorated permanent pasture into one with very good flora.* It is no use ploughing up a deteriorated pasture without removing the causes which have brought about the deterioration and, in particular, without improving the defective methods of grazing management.

Let us take another example: suppose a pasture is overgrown by rushes because it is badly drained. One may plough up this pasture and re-sow all kinds of mixtures, but the rushes will reappear unless the bad drainage which favours the growth of these weeds is removed. It is just the same if the methods of grazing which have led to the deterioration of the flora of the pasture are not improved.

The need for rest

We have some fairly detailed descriptions of what today would be called "rotational grazing" in England and France during the eighteenth century, that era of scientific awakening. Professor Johnstone-Wallace has drawn attention to the work of the Scottish farmer James Anderson, who published in 1777 a comparatively precise description of rotational grazing.†

* See M. Voisin's book *Grass Productivity* (Crosby-Lockwood), pages 284–8, reviewed on p. 210 of this issue.

† A photo-copy of Anderson's work is reproduced in M. Voisin's book, page 162.

Nevertheless, for two hundred years the none too numerous efforts which have been made to improve, however slightly, the methods of grazing management have all failed. The number of systems has multiplied but there has been scarcely any real development. All sorts of names have appeared: rational grazing, rotationed grazing, strip-grazing, controlled grazing, close folding, Hohenheim grazing system, etc. This multiplicity of names is in itself sufficient to show how far we still are from finding the right course.

In my view all these systems had—and still have—the same fault; they do not take into account the time factor. In particular, the grass has not been given the period of rest necessary, dependent on the season, between two successive grazings. As I have said, the shepherds were well aware of this need to rest the grass for a time, and they took great care never to allow the grazing of grass which had rested for too short or too long a period—that is, grass which was too young or too old.

Fertilizers on pasture

The use of fertilizers has trebled the yield of arable land. On pasture their use has not become widespread, and in many cases it has done more harm than good. To become convinced of this, it is sufficient to recall how considerably grass tetany (staggers)—that veritable cattle disease of civilization—has increased. This disease was extremely rare, indeed almost unknown a few decades ago. Its spread is encouraged by young leys, by the bad and injudicious use of nitrogenous and potassic fertilizers, as well as by exclusive feeding on very short and young grass.

I should like to stress yet again that it is above all the failure to study methods of grazing management which is the basic cause underlying this catastrophic increase of grass tetany. Whether the corn is cut by reaper-binder or by combine harvester, whether the beet is pulled by hand or machine, this does not affect the method of applying the fertilizer on the corn or beet.

In the case of grazing land, it is impossible to separate the use of fertilizers from the method of grazing management. Nitrogen cannot be applied where continuous grazing is practised. Its use is only possible and beneficial where rational grazing methods are used; sufficient time must be allowed to elapse between the application of the nitrogenous fertilizer and the use of the grass for pasture if serious accidents are not to occur sooner or later.

If these basic rules are not observed, it is no use wasting money on nitrogenous fertilizers. How well we understand now why an English farmer recently wrote in a magazine that he was suffering from an "attack of nitrogen sickness" in his pastures and that he wanted to be cured of this "nitromania". He was certainly right, for he had increased the quantity of nitrogen without adopting rational grazing methods. In such conditions the use of large quantities of nitrogenous fertilizers not only offered no advantage, but might even have been harmful to the health of the animals.

Grazing management the first priority

In conclusion, I shall repeat that, in general, I do not think our methods

of grazing management have improved for six thousand years. The reason is that in our studies and researches on pasture-lands we have neglected the question of grazing management. I am convinced that we shall make no progress as long as this continues to be the case.

Great Britain has always been the country of big farmers and stock-breeders. I often come to the meetings of the British Grassland Society and the British Society of Animal Production. May I be allowed to say first how much I always appreciate the warmth of British hospitality. But what strikes me above all is the great merit of the men, both scientific and practical, whom I meet each time at these gatherings. I am convinced that these men, following in the footsteps of James Anderson, their great ancestor and the prophet of rotational grazing, will one day be pioneers in the progress of *grazing management*.

Problems of Welsh Agriculture

PROFESSOR E. J. ROBERTS, M.A., M.SC.

University College of North Wales

Problems of disease, feeding and wintering stock are endemic to Welsh farming. The scientists can point the way, but it is up to the farmers themselves to apply the solution.

WHILE most of the important problems of Welsh agriculture also occur in other parts of Great Britain, especially in the north and west, their relative importance is not necessarily the same. To take an example, liver fluke causes severe losses in the lower-lying sheep areas of England and Scotland as well as in Wales, but it is probable that the proportion of loss to farming income from that disease is higher in parts of Wales than anywhere else. In Anglesey, for example, where fat lamb production from Welsh ewes purchased from the adjoining mountains is probably the greatest source of income, the losses in the past winter must have been higher than in any areas of similar size in the rest of Britain. It should also be added that the problems of Welsh farmers are by no means the same over the whole Principality; even in a small country like Wales, with a total area of less than 4½ million acres, the great variation in rainfall and topography results in corresponding differences in farming systems, each with its own set of inherent difficulties.

The land rises from sea level to over 3,000 feet and, roughly speaking, consists of a central mountain massif broken up by river valleys sloping down to the sea on the north, south and west. There are fertile valleys which are as favourable for dairy farming as any other districts of Britain, but these are very limited in area.

The rainfall is high over most of Wales, and this brings with it soil problems affecting stock and crops. The soils are mostly acid, so that periodic liming is essential on both lowland and mountain. More research is called

for in that connection, because in practice the degree of acidity does not appear to be as damaging to crops, clover and grass as would be expected from results in England. However, the lack of lime on the hills is such that aerial top dressings of fertilizers are at present ruled out. Research into the minimum top dressings of lime and minerals necessary for improving hill land is called for.

Over a quarter of Wales lies above 1,000 feet, and most of this area is suitable only for mountain sheep breeding. Even afforestation is very restricted above this height. The main problems of farmers in such areas are those bound up with the hill sheep—nutrition of the pregnant ewe and associated diseases, wintering of ewe lambs, and snow hazards.

Below 1,000 feet, all livestock enterprises are represented in various proportions—dairy farming and rearing of replacements, store and fattening cattle, store sheep and fat lambs; milk and fat lamb production are the two most important. Arable crops are grown to produce grain and straw for stock, and while the various problems associated with the growth of such crops are represented, their order of significance is not the same as it would be in the tillage areas of East Anglia. Hay and silage are of far greater importance in Wales.

It would be impossible, in a short article of this kind, to itemize and attempt to assess the relative significance of all the Welsh agricultural problems. There are a few of such importance that they dwarf most of the remainder, affecting as they do the standard of living of most Welsh farming families. There are problems not only for the scientist but for the farmers themselves. The scientist may be able to do no more than point the way, and it is then up to the farmer to change his attitude and approach—not an easy thing for a man of middle age or over. The scientist, for example, has pointed to silage instead of hay, but many farmers have been unable to bring themselves to make the necessary change. Where the answer to a problem lies in a dose or a vaccine, there is not the same difficulty as in changing what amounts to a method of farming.

Diseases

Most Welsh farmers would agree that diseases of sheep and cattle are their most serious problems, and that for the past year liver fluke, with its associate black disease, has been the worst of these. This has been all the more disappointing because it was regarded as having been conquered over thirty years ago, with carbon tetrachloride as a dose, or copper sulphate for dressing the snail-infested areas. Now, alas, we realize that the fluke can kill the ewes before it is sufficiently mature to be harmed by any treatment known today. What is more, pastures have remained infective not merely for two or three summer months, but all winter as well.

Space forbids a discussion of the remaining diseases, bacterial, parasitic or metabolic, but the same problems are met in other sheep areas. Twin-lamb disease is mentioned later. Hypomagnesaemia is always a menace when sheep are transferred to better grazing, and it is difficult to avoid this; it is, of course, serious also when hill ewes, whether Welsh, English or Scotch, are bought for fat lamb production on better land.

Diseases affecting cattle are serious, but Welsh conditions are not re-

sponsible for any marked differences in incidence from those in England and Scotland.

Food for February and March

There are but few farmers in Wales who are not affected by the important problem of finding end-of-winter and early spring feeding for their stock. whether mountain breeding ewes, ewes for producing fat lambs, dairy cows, or herd replacements.

The breeding flock of hill ewes is brought down to the lower slopes for the winter and, on farms possessing sufficient lowland, may be put on such land for a few weeks before and during lambing. On higher ground the grass is not only scant, but of very low nutritive value. This can be realized when the flock is brought down from, say, 1,000 feet to graze what appears to be almost bare land; though the latter looks so poor, it is surprising how the ewes quickly improve in condition on it—an observation that never fails to impress a flockmaster with the very low quality of the mountain grass from which they have been brought down.

It is an astonishing tribute to the hardiness of the mountain ewe that at a semi-starvation standard of nutrition she should be able to support a growing foetus, and supply the lamb with milk after giving birth to it. Research is being carried out at Bangor on the inheritance of such characters. Improving the food supply of the ewe results not only in a larger and more vigorous lamb at birth, but in a stronger mother with more milk; also in bigger ewes and store lambs at the autumn sales. There are fewer barren ewes, because of less abortions resulting from sub-standard nutrition, and furthermore, pregnancy toxaemia is mostly brought under control.

But not all farms have sufficient lowland. The solution of this problem is exceedingly difficult; the hill farmer is very astute, and would have found an answer to it long ago if there was a ready solution. Supplementary feeding, either with hay or concentrates, is not only expensive, but it interferes with the grazing habits of the flock; instead of seeking grass, the ewes tend to await the arrival of the food. Welsh ewes would consume ¾ lb of hay per day, or 45 lb each in two months, at a cost of about 6*s*. 6*d*. a month per ewe, with hay at £15 a ton. This is not unduly expensive in itself, but it is for the flockmaster to decide about his ability to avoid the difficulty mentioned above, also taking out the hay and avoiding wastage by trampling, and by rain. In general, the hill flock is fed hay only when the ground is covered with snow, and, even then not all are agreed about its merits.

Silage, cubes or concentrates

Silage is an alternative to hay, and ewes take to silage when the grass gets very scant, as it would from February onwards. In the interests of both cattle and sheep there should be more silage and less haymaking in the wet climate of Wales.

The feeding of silage to mountain ewes is, however, accompanied by the same kind of difficulties as giving them hay—transporting it to the hill, mud, and wastage in wet weather. Hill flockmasters are often urged to make silage on the hill, where it is required, and to utilize for this improved portions of

the mountain. This advice is often difficult to carry out because the improved areas are too small to provide enough grass for a pit or stack of silage.

In recent years, cubes of high protein cake have been used with success, about ½–½ lb daily being sufficient to keep a ewe above the danger level in the period of semi-starvation. A bag of 1 cwt would supply 230 ewes for a day, and does not require much storage space; the cubes are spread on the ground.

Supplementary feeding of ewes kept for the production of cross-bred fat lambs is not general on Welsh farms, but it would pay handsome dividends. An alternative to feeding hay, silage or concentrates is thinner stocking. In addition to giving earlier and heavier lambs, the supplementary feeding or reduced stocking would cut down losses from twin-lamb disease, and result in at least two beneficial effects—fewer cull lambs, and an opportunity for the land to freshen up and avoid the sheep-sick condition. Sheep-sick land will become a problem in the future, as it was in the 1930s, and early clearance of lambs helps to avoid it.

Wintering of ewe lambs

The difficulty of providing the future flock replacements with better grazing in their first winter has been solved in the past by finding tack for them. If this were not done, maturity would be delayed, and instead of lambing first at two years of age, ewes would not breed until three years old. This traditional method of providing winter keep is getting more and more difficult however. Besides the ever-mounting costs, now about 32–34*s.* per lamb, tack is more difficult to find, because it is as profitable to keep dairy cows as to take in lambs for wintering. The scarcity of tack has also made it difficult to insist on the traditional conditions once expected, such as the land having had no sheep on it during the previous summer.

One method suggested for solving this difficulty is keeping the lambs at home, and housing them in wintering sheds provided with slatted floors. The lambs would be provided with 1 lb of hay each day, which would cost about 24*s.* a lamb for five months. The lambs could not also range over the hill without reducing the number of ewes that could be kept for breeding. Experiments at the University College Farm, Bangor, are proposed on this problem.

Small farm problems

There are a number of problems stemming from the smallness of many farms, and these are found also in other parts of Britain. Thus beef production, or the raising of beef calves, is not a suitable enterprise for small farms, nor could mechanized cereal growing be carried out so cheaply even if the climate were suitable. Not only the size of farms, but the areas of the fields are against large machines, and contractors are uncommon in the Principality probably for that reason. Furthermore, the frequency of outcrops of rock and boulders discourages contractors from all kinds of field work, including drainage. While such difficulties may not be completely solved in the future by developments in machinery, there is no doubt that they could be eased considerably.

Another small farm problem of contemporary interest is the lack of scope for simplification or stream-lining of enterprises. To concentrate on one or two enterprises only would, in the opinion of many, not be as wise on small as on large holdings.

In a country in which there is "land hunger"—that is to say scarcity of farms—intensive pigs and poultry might be thought to offer possibilities, but the unsuitability of the climate for corn growing is probably mainly responsible for the lack of developments. Nevertheless, many small farmers, especially those whose family wish to help, might profitably include a sow unit, or the breeding of layers, even though all the concentrates would have to be bought. This may seem imprudent advice at a time of surplus pigs and eggs, but the favourable position of the small farmer as regards the application of care and skill would find reward for those two enterprises, and make many individuals better off.

The large proportion of small farms in Wales—about 50 per cent are of less than 30 acres—adds importance to the Government's Small Farmer Scheme. This will enable many to increase their earning power by helping to resolve some of the problems that have been mentioned. More and better grass, hay and silage as a result of an improved fertilizer programme would lead to more cows and more milk per cow, or to bigger and stronger lambs, not to mention reduced losses from barrenness and twin-lamb disease. Although the Scheme cannot completely solve any one of the major problems, it can relieve more than one of these difficulties by adding to the farmers' earning power. There is nothing better than a bank balance for equipping a farmer to meet his problems!

Liver Fluke in Wales

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Good grazing management, and the treatment of both sheep and cattle to control fluke, rather than desperate measures after infestation has become heavy, can do much to reduce losses.

IF anything were needed to emphasize the findings of the Engledow Committee, it is the extremely heavy loss of sheep, and to a less extent cattle, in Wales from fluke and associated black disease (necrotic hepatitis) last winter. Analysis of the causes of death among sheep examined at the Veterinary Investigation Centre, Bangor, in any winter clearly show these two diseases to be responsible for between 30 and 40 per cent of the total losses. In Anglesey 12·9 per cent of the ewe stock at risk died last winter, a total loss of 12,000 ewes, of which 8–9,000 died of fluke and/or black disease. Some observers have placed the figure at 20,000. A total figure of this nature does not perhaps impress readers as much as to learn that many farmers lost three-quarters of their ewe flock, and some the whole lot. A comparable picture can also be painted for other counties in Wales.

With the discovery by Dr. R. F. Montgomerie at the University College of

North Wales in the middle 1920s that affected sheep could be treated successfully with carbon tetrachloride, the problem of fluke was considered to be finally settled. Much dosing of sheep has gone on since then, and its ready availability may have induced a sense of false security among the farming community in those years when the disease has not appeared as a serious problem. But it was soon found not to be effective in the treatment of massive fluke infestation, or acute fluke, and in bad years it is far from being a valuable safeguard.

Cattle and fluke

Whilst all Welsh farmers recognize the importance of fluke as a disease causing loss in their sheep, they, like others, do not appreciate so readily its association with disease in cattle. Perhaps this is not surprising, for it is only in an abnormal season, when losses in sheep are rife, that the disease in cattle shows obvious clinical signs, and then generally in the younger cattle. More often than not, fluke disease in cattle is evident only at slaughter, frequently in animals in prime condition, when it is reported to the owner that the liver has been partly or wholly condemned by the meat inspector.

It is most important to a correct understanding and control of fluke that farmers should be fully aware of its possible presence in cattle. This is particularly so, for instance, when trying to determine how sheep on a farm may have become infested. It is too often believed that sheep put out on fields which have been grazed only by cattle in the previous two years or more must be safe. No such assumption should ever be made, for in the same way that sheep help to soil and contaminate pasture with fluke eggs, so also must cattle—or, indeed, rabbits. Thus, if such pastures also harbour the essential intermediate host snail, cattle are just as likely to be responsible for those snails becoming infected as are sheep. Hence, cattle can eventually make a pasture not only potentially dangerous to themselves, but also to the sheep that follow them. In any scheme for the control of fluke, whether by dosing or by pasture management, it is short-sighted policy to overlook the part which cattle may play.

Climate and fluke

The association in the farmer's mind of a wet summer with heavy losses from fluke the following winter is almost traditional. In an area such as Wales a wet summer therefore assumes a significance for farmers far and above the difficulties of harvesting and the poor quality of fodder it is likely to cause. They have also to contend with possible losses in their sheep from fluke.

Dr. Ollerenshaw, in his very valuable contribution (*Agriculture*, August 1958), showed clearly the relationship between climate and liver fluke, and the reason why fluke is a constant hazard on the lowland areas of Wales. From his observations, it is evident that May to October are the most critical months for Welsh sheep farmers, since it is mainly during this time that the temperature remains high enough for the intermediate stages of the fluke to develop in the host snail and for them to emerge on to the grass and so become available to grazing animals. If, besides a suitable temperature, suitable moisture conditions prevail, as in a wet summer, then circumstances

are doubly favourable, since the snail can propagate and, in areas of flooding or bad drainage, spread and contaminate with fluke cysts areas unlikely in a dry summer to become a source of infestation to grazing animals. Since the bulk of this infestation passes out from the snail on to the pasture in late summer and autumn and persists on the herbage into the winter, a major aim in the control of fluke must be a strategic dressing in August of suspected areas with a molluscicide such as copper sulphate or sodium pentachlorophenate just before infestation of the pasture is likely to occur. It may be difficult to understand the need for such a dressing in a dry summer, but Welsh farmers are well advised, having located suspected snail habitats on their land, to make this one strategic dressing. In a summer when any two consecutive months between May and October are wet, an additional dressing in the following month is likely to be very valuable indeed in helping to prevent serious losses from fluke during the ensuing winter. If, for example, May and June prove to be wet, an additional dressing is advocated in July.

Pasture conditions and fluke

Whilst bad drainage may be due to many things, such as the lie of the land, neglected ditches, or poor or complete lack of maintenance of major and intermediate rivers and streams, broken drains also cause conditions leading to the development of suitable snail habitats. And it is claimed by many that the tractor's replacement of the horse has tended to increase the seriousness of this problem. The majority of sheep in Wales graze the hill or mountain land, and in consequence a feeling of false security exists among the owners of such flocks that by the very nature of their grazing these sheep are immune to the ravages of fluke.

Two theories are advanced for this. First, it is claimed, quite rightly, that the intermediate host snail will not live in "acid" or "peaty" water. Nevertheless there are small areas, even on the hill grazings, which are sufficiently alkaline to allow snails to survive. Moreover, the practice of liming peaty land not only produces a very palatable bite for sheep, but also, by reducing its acidity, favours the snails. Second, hill land and mountain land is claimed to be generally well drained and dry, and therefore unable to harbour snails. But on such areas spring water emerging and running away down the slope in the form of a "flush" is not uncommon (see the illustration on p. vi of the art inset). Here, throughout the summer, in complete contrast to the rest of the grazing, is an oasis of green succulent pasture; but it is also often a place in which the menace of the fluke snail is hidden. In all, therefore, Welsh hill farmers have to face conditions at least potentially dangerous as sources of fluke. Although it may only occasionally be a cause of serious loss, they should realize that their draft ewes may well have an infestation in their livers, sufficient to contaminate a lowland pasture to which they may move later—with possible repercussions.

Proposed control measures

The actual and potential seriousness of fluke has stimulated the Animal Health Division of the Ministry of Agriculture in Wales to take special measures to deal with the problem. It is hoped to establish a service of trained staff upon which the sheep farmer can call to determine and advise

him upon the location of potential snail habitats. In this way he will later be able to take steps, in consultation with his veterinary surgeon and possibly his drainage officer, to plan a system of fluke control based on dosing the susceptible livestock and strategic treatment of the potentially dangerous areas on his farm. It may be a matter of dressing the area, fencing, alternate grazing, or indeed drainage where this can be recommended as a practical proposition. At the same time, it is hoped to urge the farmer to consider immediately certain practical measures of a general nature which, in the light of last winter's experience, will stimulate him to be ready for next autumn and winter, even though we hope it will be a dry summer.

In this general sense, farmers may be persuaded to take a look at their farm to consider what are the likely places (see pp. vi and vii of the art inset) where snails could be present—usually badly-drained rushy areas, shallow drainage ditches, heavy, poorly-drained fields or the site of a broken drain. They should then try to find alternative grazing confined to known dry fields. This might be considered even at the expense of increasing the stocking rate, provided the grazing can be supplemented (for example, with silage) from the end of December onwards. From mid-August until mid-November it is relatively safe to graze aftermath if cattle have not grazed it since the field was put up for hay. If no alternative grazing can be made available any suspicious area can be fenced off.

In many cases this may call for some revolutionary practices in sheep grazing. Thought should also be given to possible drainage improvements, to the reconditioning of ditches and of underdrains—so that no areas of the lowland pastures are waterlogged or indeed sufficiently wet to harbour snails. In consultation with his veterinary surgeon, the farmer should also think of strategically dosing his sheep and cattle, using certain new techniques in administration to reduce to a minimum the ever constant danger of poisoning. This will call for the treatment, at least once, as soon as possible, of ewes and cattle (preferably in May or June) to reduce the burden of flukes picked up earlier in the year. In this way the amount of contamination from fluke eggs reaching the pasture in this critical summer period will be reduced. After all, it is the number of fluke-infested snails rather than the total number of snails that decides the destiny of the flock.

This spring/summer treatment must be followed up by routine dosing of the ewes from October onwards, at periods of three weeks, to within a month or so of lambing; cattle should be dosed twice during this period, once in November and again in February. Hill and mountain sheep may have to be dealt with differently. In essence, treatment of all sheep going up on to the mountain pastures should be encouraged, to avoid as far as possible contamination of "flushes" and other heavily-grazed areas where snails may be found. Likewise, those that come off the mountain to "ffridd" or "in-bye" land should, as far as possible, be given the routine winter dosing programme already outlined.

It would seem then, that even though fluke disease in Wales may assume greater proportions than in other parts of Britain, it is not an insurmountable problem, and that a great deal can be done to reduce the losses by good shepherding. Aim particularly at strategic autumn and winter grazing and treatment of flocks and herds in such a way as to control the fluke, rather than desperate alleviation of an accomplished tragedy.

Pig Progeny Testing

R. F. JOHNSON

National Pig Progeny Testing Board

Progeny testing is an important tool in the hands of breeders to secure the right kind of pig and the right kind of profit.

THE hope of obtaining profit is the sole reason for keeping pigs but, although the profit motive is so important, it is really secondary to the basic requirement of producing the correct type of carcass. Profit depends not only upon costs, but primarily upon the ability to sell the product. It is no good producing cheaply a type of carcass which finds no willing buyer.

This is important, for the pig, unlike cows, sheep and poultry, has only its carcass to offer. For this reason, if for no other, it could be suggested that the sole criterion on which a pig may be judged is its ability to produce a carcass capable of meeting market requirements.

The profit in pig-keeping depends upon the health and fecundity of the breeding stock, and the ability of their progeny to grow quickly and cheaply to any desired market weight, and then to produce the right sort of carcass. Some may suggest that management can look after these requirements, as it can to some extent determine the amount of fat in the carcass, the speed of growth and feed efficiency. In addition, of course, it can be used to cut other costs. This is so; management is important, up to a certain point. But no matter how good the management, it is still incapable of producing successful results from pigs which are genetically incapable of either growing quickly, feeding cheaply, or producing a good carcass.

Good management, to have its reward, must be applied to a pig which is capable of responding. Such pigs can result only from a sound breeding policy. Farmers who contemplate introducing more efficient management should realize that good management will cost a little more than bad, and so this change of policy should not take place until steps have been taken to ensure that a better pig will be provided for the better management. Otherwise efforts made will be wasted. There has been an undoubted improvement in the pigs of this country over the last twenty-five years. One has only to remember the type of the early 'thirties, and compare it with that of today, to appreciate that breeders responsible for the improvement have done a good job, and were breeders in every sense of the word.

Selection by eye and experience

However, they had only two tools to aid them. First, a sense of good stockmanship and the ability to select breeding stock by eye. Second, they depended upon their accumulated knowledge to indicate those families which, when brought together, had the best chance of producing the type they were after. Both of these are rather hit and miss. An eye judgment can be mistaken at the best of times, especially where length is concerned. A study of families in order to indicate nicking qualities requires knowledge of

a very broad picture, and for this reason is rather beyond the scope of the single breeder within his own herd.

Whilst these two tools have served their purpose in the past, it is doubtful whether by themselves they could be expected to achieve much further success. The considerable improvement in the early 'thirties was due to two main considerations. The scope was extremely wide, and the improvement has been concentrated on type or shape. A breeding policy based on a single character is fairly simple when compared with one requiring the recognition of several characters, as will be the case in the future. Now that the scope for improvement in type or shape has been narrowed so considerably, the breeder must look to other guides if he is to continue the success achieved in the past. I am certain that only progeny testing, together with recording, can provide a basis for the future well-being of the pig industry.

Progeny testing is simple practice. It is merely the bringing together of progeny of various boars to one common piggery, where they are subjected to identical management, environmental conditions and feeding, and where the variations which occur amongst the commercially important characters are measured and recorded. Because all the factors of management are standardized, the variations displayed are genetic and can be used as the basis of a successful breeding policy. Any such policy must depend upon the selection of breeding stock, but it is only careful and accurate selection which leads to improvement. The National Pig Progeny Testing Board recognizes this, in that all progeny testing information is designed to enable breeders to compare the potential of one boar with another within the same breed—a comparison based on the genetic variation.

Variation even in good pigs

Let me stress what is considered to be the most important point in all this. If the pigs on test now at any of the Board's Stations were to be examined, I am sure it would be agreed that they were all of a very good type; in fact of the type which has resulted from the last twenty-five years' successful breeding policy. Nevertheless, the work of the Board is already indicating that within this good type there are significant variations in characteristics of financial importance to all who are in pig-keeping. We already know that the progeny of one boar can be fed to bacon weight more cheaply than the progeny of another, even to the extent of up to £2 a pig. Can we afford to ignore such a variation? We also know that between the progeny of boars there is a variation in length of some 55 mm, in age to slaughter of over six weeks, and in the ability of progeny to obtain AA+ of from 6 to 100 per cent.

It should be emphasized that these variations are occurring amongst characters which are incapable of eye judgment on the hoof, but that they are occurring within the good type which has been successfully improved by visual judgment. It is for this reason that selection by eye has its limitations; improvement is restricted to those characters which can be visually assessed. Breeders must therefore include in their selection assessments the information provided by progeny testing which covers the unseen characters.

This does not mean that breeders in the future should base everything on progeny testing records. Success will result from a commonsense combination of this type of information and a continued culling by eye of those pigs

whose physical conformation suggests they are unworthy to be breeders, or unworthy representatives of the breed.

Progeny tests at the Board's five stations

The Board has five stations—one in Scotland, one in Wales, and three in England—all of which have been paid for by producers. The pig industry, therefore, has committed itself to a programme of progeny testing, and it is the Board's object to make sure that this programme is carried out as efficiently as possible on behalf of producers. All stations are identical in construction, and a common set of environmental conditions is maintained. It follows that results obtained at any one station are directly comparable with results obtained at any other. Boars may therefore be compared directly, irrespective of where their progeny were tested.

In brief, a progeny test is based upon representatives of four litters out of different dams, none of which may be full sisters, all sired by the same boar. The representatives of the litter consist of two hogs and two gilts, which must be within a weight range of 8 lb when delivered to a station—a ruling which ensures that the four pigs are truly representative of the litter. As soon as the four groups have completed their test, a report is issued to the breeder showing the performance and carcass qualities of each pig within the group, the average for each group, and a final average figure for the boar based on the four groups.

Each quarter the Board advertises the names of the boars which have completed their test during the previous three months, and anyone interested can then apply for copies of the reports which have been issued to owners of the boars. By so doing, the Board ensures that full information resulting from any test will be available to the industry as soon as possible after the completion of the test. The standard of management at the stations is comparable with that adopted in the ordinary good herd. No effort is made by way of management or quality of ration to ensure that the best possible results will be achieved, since to do so would invalidate one of the principles of progeny testing. The boars which progeny testing indicates as being superior must also prove to be superior in ordinary farm conditions, which means that the management they have received at the station must be comparable with what they will receive on the farm.

The system of feeding can be termed as "semi *ad lib*." This means that each pig receives a daily ration of as much as it can clear from the trough in twenty minutes. Considerable variation is noticed between the appetites of pigs of different litters, ranging from 6 to 9 lb a day at slaughter weight.

So far, the progeny of some boars have averaged a maximum daily ration of just over 6½ lb a day, whilst the progeny of others have averaged 8 lb daily. Some of the best boars tested so far, including carcass quality, had progeny which had proved to be the heaviest feeders.

The purpose of progeny testing is to permit a free expression of genetic potential, and if all the pigs were subjected to a common standard of feeding, then the potential of the better boars would be cloaked.

Finally, it should be stressed that progeny testing in itself is incapable of bringing about any improvement; it can only be the tool with which the breeder can achieve improvement.

The Oxford University Field Station

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An account of a successful combination of research (chiefly on crops and pastures and their weeds) and practical farming.

In 1950 the Department of Agriculture at Oxford was fortunate in being able to take over a farm only 3½ miles away, on the University's Wytham estate, with the object of establishing a field station having facilities both for post-graduate research, and for teaching undergraduates. The condition of the farm when taken over, and the development of the buildings, have already been described in *Agriculture*,* though certain modifications and improvements have been made since that time.

Not only is research carried out by members of the staff of the Department and post-graduate students; the Agricultural Research Council's Unit of experimental Agronomy, under Professor G. E. Blackman, has field research facilities at the Field Station. There are a well-equipped field laboratory, glasshouses and a pot culture area. The Unit is primarily concerned with fundamental work on the selection of herbicides, and with development work on the potential value of new herbicides and their applications in practice. Besides this a separate section of the Unit is interested in the breeding and agronomy of crops relatively new to Britain, such as oilseed poppies, rapes, and hybrid maize for grain and silage.

At the Field Station, the attempt to combine research with practical farming has been very successful on the whole. The commercial side of the farm used for undergraduate teaching makes a profit in most years, but at the same time a good deal of research is pursued. Research projects are given priority but, as far as possible, experiments are conducted on existing crops or pasture. If suitable crops are not available, separate areas or fields are allocated for the purpose. Most of the detailed work is centred on crops and pastures and their weeds, and if research on animals is carried out, it is of such a nature that it can be superimposed on the existing stock without much risk of serious financial loss.

Of the farm's 330 acres, about 150 adjoin the river Thames in a long narrow strip, and are liable to flooding in a wet winter (and in a summer like 1958). The soil here is mostly alluvium over clay, but there are sandy patches on two of the fields. Drainage is impossible, for much of the land is at river level, and there is a fall of only a few inches over the 1½ miles of river frontage. Above the river flats is a very narrow gravel terrace, which broadens out to give some twenty-five acres of lighter land on which the buildings stand. Above this again, and sloping up to the Wytham woods, is a belt of heavy, sticky, Oxford Clay, with a few patches of clay/gravel colluvium. This land is very wet, for it takes much of the drainage from the hill above.

* Farm Buildings at Oxford University Field Station. M. H. R. Soper. *Agriculture*, 1955, **61**, 588–93.

The farm carries dairy cows and pigs as its main livestock enterprises, and the general policy is to keep the wetter fields near the river as permanent pasture, to provide a tougher and more persistent sward. The drier riverside pastures, which are fortunately nearest to the buildings, are in three blocks. These will be ploughed and direct reseeded in rotation to provide fresh maiden seeds each year for the dairy herd. It is this land that provides most of the grazing and silage for the cows.

Cropping at the Field Station

On the arable land, which totals approximately 120 acres, wheat is the main cash crop, and yields of two tons or more per acre have been obtained in a good season. Barley, grown to give a maximum yield for feeding, is the other important cereal; in recent years only a few acres of oats have been sown, owing to lodging and relatively low yields. Barley has proved a perfectly suitable cereal for both cow and young stock rations, and is a far better economic proposition than oats.

Kale, beans and 1–2-year leys are the other rotation crops on the arable land. Root crops were abandoned some years ago as taking too much labour and being too expensive to grow. The heavy soil suits beans admirably, and 6–8 acres of either winter or spring types are sown each year. Because of heavy infestations of wild oats at the time of take-over, and a desire to develop new lines of spring beans, this type of bean is being grown now in preference to the autumn-sown crop.

The utilization of kale is a bigger problem on this wet land than its cultivation. After several attempts at grazing, which usually ended in an appalling quagmire or in cows with bad feet, the crop has been cut for the past two years with a silorator. Unless the field is particularly wet, this seems to be the solution, for the cows eat more of the pulped kale, there is no waste of stem, and we have little difficulty in dealing with the stubble in the following spring, for the crop is cut close to the ground.

The 1–2-year leys now consist of S.24 perennial ryegrass and S.100 clover. This mixture has been adopted in preference to Italian ryegrass, for it gives a tighter sward for carrying the breeding sows, and is less liable to run to seed. Furthermore, the mixture provides a good silage or hay cut on the areas not folded, and an excellent sward for ploughing-in at the end of its second winter.

A new crop, hybrid maize for silage, is now being grown to an increasing extent, following trials carried out by the A.R.C. Unit. In terms of yield of dry matter per acre, the performance of the best hybrids seems to compare favourably with that of kale, though the protein content is not so high. The advantage on the heavy land farm is that the crop can be cut and ensiled in October when the land is still relatively dry, and the problem of winter utilization is therefore greatly eased. Small areas of the crop have been cut for the past two years with the modified silorator and ensiled without difficulty. Maize has one further important advantage, arising from the development of simazine as a herbicide. This chemical worked into the seedbed, combined with a well-grown crop, can have an excellent cleaning effect. The great trouble with maize is birds, for rooks can clear a field in a couple of days when the crop is emerging, and drastic control measures are essential.

This crop is still in the development stage, and probably will never take the place of grass silage in most of Great Britain; it may supplement grass silage in the more favourable environments and, perhaps, replace kale or roots as a winter food on land where that crop presents difficulties. It may also prove a very valuable silage for fattening beef cattle.

The big problem of cropping at the Field Station is the presence of wild oats, which frequently precludes the sowing of autumn crops on certain fields. The standard method of cleaning is to plough once or twice in the autumn and follow by spring cultivations to destroy as many seedlings as possible. These operations are followed by a very late sowing of barley (first week in May), from which most of the surviving wild oat plants are caught by the combine before the seed is shed. But another cleaning crop is needed, and in this connection, the present experiments using simazine with spring beans are quite promising. If attempts to produce a quicker-maturing and higher-yielding spring bean should prove successful, an economical spring cleaning crop needing little labour would then be provided, and some of the risks attending the growing of winter beans, for example chocolate spot, avoided.

Techniques with new herbicides

The value of new herbicides against wild oats is being assessed by Mr. J. Fryer of the A.R.C. Unit, and trials this season with the logarithmic sprayer are yielding some interesting results.

The introduction of dalapon as a herbicide some years ago has led to a new technique in direct reseeding, pioneered by Mr. J. G. Elliott, also of the A.R.C. Unit. The ploughing and reseeding of the wetter river meadows presents many difficulties, and a trial was laid down in 1956 in which dalapon and 2,4-D were used to kill the old sward *in situ* in the autumn, and then different ways of sowing the new grass mixture were tried in the following spring. At present, this and other evidence suggests that such a method may have valuable applications in the renovation of old pastures, under a variety of conditions.

Dr. E. K. Woodford, Assistant Director of the A.R.C. Unit, suggested in a recent paper to the Farmers' Club* that the development of new herbicides might well affect our methods of cultivation in the future. To study the types of problem involved, a field on the clay/gravel colluvium was divided into four strips in the autumn of 1957. Two of these strips are never ploughed, while two are cultivated in the normal way. The primary object is to study the effect of ploughing on the weeds, and to determine what herbicidal applications would be necessary if ploughing was not carried out. The strips should also provide further information on the value of surface mulching compared with ploughing in farmyard manure and organic matter, on the cost of alternative methods of cultivation to ploughing, and so on. So far, there has been no difference in the growth of kale or spring wheat in the two seasons between the ploughed and unploughed areas, nor has there been any serious difficulty in obtaining seedbeds with a cultivator and disc harrow.

Scattered throughout the farm are a considerable number of small plots

* A note on this paper, under the heading "Chemical Weed-Killers", appeared in *Agriculture*, 1959, **65**, 582–3.

of various kinds; for example, those concerned with the nodulation of legumes (Mr. G. B. Masefield), the ecology of weeds (Dr. J. L. Harper), the pathology of cereals (Mr. R. L. Lucas), and my plots of beans. In addition, one field of seven acres (with a plant breeding cage) is given over to experimental plots mostly relating to the researches of the A.R.C. Unit on new crops. At the present time, this work is mainly confined to maize and oil-seed poppies. Variety trials of existing American and Continental maize hybrids, both for grain and silage production, have been carried out for several years, and new hybrids are also being developed by Dr. E. S. Bunting. The aim of the research on poppies is to combine, in one variety, earliness, a good yield of seed and a high morphine content in the capsule. Other factors being taken into account are methods of mechanized cultivation and harvesting, the best time for harvest, and the leaching of the morphine under bad weather conditions at harvest.

Professor Blackman, with Dr. Brittain and Mr. Godbert, is further investigating the ways in which environmental and other factors limit either the growth of individual plants or the dry matter production of plant populations. The aim is to evaluate the ultimate limits of productivity.

Friesian herd

With livestock, the policy is to carry a herd of some 50 Friesian cows, with up to 45 in milk at any one time, calving more or less all the year round. These cows are milked in a 3-unit, 3-standing, abreast-type parlour by one man. He has some assistance with feeding in the winter from the lad who looks after the young stock. All calves are reared, but the steers are usually sold as stores, for with 150 head of cattle on approximately 200 acres of grass (which is usually very wet) it has not been possible to finish all of them adequately. The herd is run as a commercial unit and housed in yards during the winter, being fed largely on kale and silage. The latter is made in a long clamp in front of the yards; a temporary manger of straw bales and old scaffolding poles laid horizontally runs the length of the face, and the silage is simply cut off and thrown on to it. The whole manger is moved forward into the clamp as each main slice of silage is consumed. This system saves any carting of the silage, but enables the quantity being fed to the herd as a whole to be regulated. If wastage is to be controlled, the length of the manger must be kept to a minimum, or the cows will turn sideways and throw a certain amount down through the rails. Lacerated kale, hay and concentrates are fed in the yard mangers. Feeding in the parlour was abandoned some years ago, without regret.

During the summer the herd is grazed intensively on leys, and in 1958 irrigation equipment was bought to ensure a continuous supply of grass on those fields near the river. Needless to say, this equipment was little used in 1958. The cows are now being served at first heat after calving in most cases, to try to obtain a higher yield per cow per year, rather than mere high lactation yields. The average N.M.R. yield over the past five years has varied between 950 and 1,000 gallons.

Three years ago, a change was made to a dry-feeding system for the calves, and a modified Rowett Research Institute mixture is introduced at five days, and the calves abruptly weaned at three weeks. This winter, an attempt to

replace half the normal 6 pints per day intake of whole milk with buttermilk has not been entirely satisfactory, and a return to the full 15 gallons total may be made in the autumn.

Large White pigs

The pig unit consists of some twenty Large White sows farrowed in folds on the temporary leys, all progeny being sent to the bacon factory. Owing to the bad conditions on this soil in wet weather, we are seriously thinking of moving the huts on to a concrete slab and providing them with modern conveniences—lamps, etc.—for the six winter months. Such a system would mean less poaching of the land and less discomfort for man and beast, though the in-pig stock would still be run out.

Because of a sequence of misfortunes, the pigs have definitely been losing money for the past two or three years. Firstly, a severe outbreak of virus pneumonia made us decide to build up a virus-free herd; this was achieved at considerable cost only to be followed immediately by inclusion-body rhinitis which, after causing unthriftiness for some months, disappeared as mysteriously as it had come. Worse was to follow, for a very severe attack of "baby pig disease", due to infection with a coliform organism, followed, causing the loss of several complete litters within forty-eight hours of birth in the summer of 1958, and a trail of small, unthrifty litters thereafter. A controlled experiment is now in progress with a specially-prepared vaccine, but results are not yet available for publication. It was interesting to note that several pigs were also lost from bowel oedema in 1958, probably due to infection with the same organism at a later stage. This infection may be more widespread in pig herds than is realized, for it is easy to assume that the young pigs have been crushed by the sow, whereas they have in fact died from the disease before being laid on.

A sheep flock would not be a satisfactory enterprise because of the wetness of the land in the winter months, but a few ewes are kept for demonstration purposes, together with a flock of approximately 100 birds on deep litter in a loft.

Profits in five years out of six

The finances of the farm must of necessity be rather complex. Any field work carried out for, or materials supplied to, the A.R.C. Unit are charged to an experimental account. The Unit also employs its own field workers, so that the farm men are not often employed on purely experimental work, but otherwise the farm account carries all losses due to research. No rent is paid to the University, but the account carries the salaries of a farm manager and farm secretary, which greatly exceed any rental figure that could be charged on a normal basis. In spite of these overheads, profits have been made in five out of the last six years, and have paid for a considerable range of improvements.

Chinchilla Farming in Britain

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A short guide to keeping and breeding chinchillas, with a warning that this is no get-rich-quick business, but one calling for considerable capital, patience and skill.

JUST now, when many advertisements are appearing in the press indicating sources of chinchilla breeding stock and, in some cases, painting a glowing picture of the profits to be made from keeping these animals, it is pertinent to review briefly the feeding and breeding of chinchillas and the markets for their pelts. A question has been asked in Parliament; it is hoped that the remarks made there, and the observations set out here, may be helpful to anyone considering chinchillas as either a hobby or a livelihood.

Many people confuse the chinchilla with the chinchilla rabbit, but they are quite different. The latter is a true rabbit, of the family *Leporidae*, which happens to have a coat resembling the chinchilla's in type and colour. If the many varieties of fancy rabbits are considered, the names "fox" and "lilac" will be found, but no one would confuse these with the rabbit's greatest natural enemy or a charming flowering tree. Chinchillas certainly do not breed with the rapidity of rabbits, whose abilities in that direction are a byword.

The chinchilla is a ground rodent, and the usual variety, *Chinchilla lanigera*, is a native of the Chilean Andes. When the Spaniards settled in those regions, they trapped it for its fur, which became the royal fur of Spain, and the population was very seriously reduced. The domestication of the Chinchilla began in America only thirty-six years ago. The animal is fairly small, weighing 1½–2¼ lb at full maturity. It is grey, with a roundish body and a rather bushy tail about half as long as the rest of the body. The ears are quite big, rounded, and free from long hairs, and it has a well-developed set of whiskers, a not uncommon attribute of animals which are primarily nocturnal. The hind legs are powerful, and developed to allow the animal to hop or jump, though it usually walks in a normal way. The fore-paws are handlike and used to convey food to the mouth. The fur is 1–1½ inches long, arising in close tufts of seventy or more very fine hairs guarded by one coarse hair, and is set at right-angles to the skin; it cannot be laid to give the sleek appearance of mink or sable fur.

Making a start

Anyone who is thinking of starting to keep chinchillas should consult the Official Grader, Blend Trast Fur Grading System, 5 Windmill Road, Chiswick, London, W.4, who has a wide experience of the chinchilla trade both here and in other countries, and can give advice over a wide field. The beginner is usually advised to start with one or more monogamous breeding pairs and to keep each pair in a separate cage; from these small

beginnings a herd can be built up by keeping the best of the progeny. As a monogamous pair may cost up to £350, it will be evident that considerable capital will be locked up in the livestock, quite apart from the cages and equipment required.

The cages are probably best made of metal, as the chinchilla is a rodent and will soon gnaw the exposed edges of woodwork. However, any handyman can make suitable wooden cages, and if the edges of the woodwork are protected by strip metal or fine mesh wire netting they can be perfectly satisfactory and reasonably cheap. A pair needs a cage about 30 inches long by 24 inches wide and 20 inches high. Some breeders include a nest or sleeping box 12 inches square and 15 inches deep, but this is not absolutely necessary. Each cage will require vessels for food and water, a small rack to hold hay, and a dusting box. The dusting box should be 12 by 15 inches and 6 inches deep, and be half filled with a mixture of sand and fuller's earth. Some branches or blocks of wood should be put in the cage, since these are a great help in keeping the teeth sharp and the incisors, or main front teeth, regular and the right length.

For the more experienced breeder, colony breeding will help to reduce the overhead costs but will entail more careful study of the animals around the mating and breeding seasons. This system allows a particularly valuable male to be mated to a fair number of females and so leads to more rapid herd improvement. A recent development, which seems to combine the simplicity of the single cage for mating and breeding with the wider use of a tiptop male, is the battery of six cages and a gallery. Each cage holds one female. The gallery, which is detachable, houses the male, and has an entrance to each cage. The male lives in the gallery and can enter the cage of any female at will, but the females cannot get into the gallery, as they are fitted with plastic collars. Once the six females have been mated, the male in his gallery can be transferred to another block of cages.

Feeding

Chinchillas are essentially herbivorous, and in the wild state live mainly on grasses, seeds and the bark of trees. In captivity they require a supply of really good, sweet hay, and either mixed cereal grains or a diet of specially compounded pellets. Some green food, such as beet tops or brassica leaves, and a few carrots are also desirable. Lettuce leaves must not be fed to chinchillas.

As the chinchilla is mainly nocturnal, it should be fed in the late afternoon or early evening. During the feeding the dusting box should be put in the cage. The animals are quick to use it, and it need not be left in the cage very long. Chinchillas are very quick in their movements and can easily either escape from the cage or hurt themselves if they are frightened, so they must be treated quietly and all the movements of the attendant should be slow and deliberate. If treated in this way they will soon get accustomed to their attendant and become quite friendly.

It is best to establish a definite diet and vary it as little as possible. The most reliable feeding for a pair is three or four handfuls of good hay and two tablespoonfuls of pellets per day, with a supply of greens and carrots. It is unwise to offer a variety of titbits, as this soon leads to digestive upsets.

The animals should not be overfed, but should be given just as much as experience shows they will clear up. Intelligent observation of individual animals will soon enable their specific requirements and likes and dislikes to be noted.

Breeding

Chinchillas will normally breed when 9–11 months old, and the normal expectation of a litter will be one, two or three, in that order, with an overall average of 1·7 young per litter. Under British conditions they will usually breed twice a year, sometimes three times. Mating can be expected at any time of year, but more usually between December and July. The gestation period of *Chinchilla lanigera* is 111 or 112 days, but in the rather larger and browner *Chinchilla brevicaudata* it is 128 days.

When mating has taken place the female releases a "plug", 1–1¼-inches long, as thick as a pencil and gelatinous in texture. This is the sign that must be carefully looked for, especially by the beginner. As it quickly dries and shrivels, it must be looked for each morning and evening. The date of mating should be noted on the pen record card. The female may mate again within 36 hours of having a litter at any time of year, but under these circumstances no "plug" is evacuated, and a weight increase will be the only guide to pregnancy. A good pair of scales weighing up to four pounds and reading accurately to one-eighth of an ounce is an asset, not only for checking on suspected pregnancy but also for noting the progress of the growing young.

The male of a monogamous pair may be left in the cage with the female until shortly before the litter is due, when he should be removed to a spare cage. Otherwise the female may very well turn spiteful towards him at this stage. He can be returned a few hours after the litter has arrived.

The young weigh 1½–2 oz at birth, and are born fully furred, with their eyes open and a full set of teeth. The date of the litter and the sexes of the young should be entered on the pen card, which will already have the tattoo marks of the male and the female on it. The female will normally suckle her young, and wean them herself when they are eight weeks old or so. Soon after weaning, the young should be tattooed in the ear with their identity number, using special tattoo instruments available from pet stores or small shops supplying animals. The sexes need not be separated until they are five or six months old.

Characteristics of chinchilla fur

The chinchilla pelt is easily the lightest fur on the market, and area for area weighs no more than a rayon material. It is not among the hard-wearing furs, and for that reason is seldom used for coats. Its main use is for trimming gowns and for evening wraps. The North American chinchilla breeders have evolved scales of points based on the quality of the fur, and their breeding stock is generally sold with a reference to the quality number of the individual and its ancestors. The United Kingdom is following this lead. Breeding stock should be bought on the basis of quality of fur and the breeding record of the herd in respect of fertility and litter size. The purchase of cheap breeding stock not backed by any qualification as to fur or fertility

will be a doubtful proposition, and will make the sale of their progeny difficult. In the case of the monogamous-pair breeding method, it would seem logical to introduce new blood periodically to avoid the effects of too close inbreeding, which may seriously reduce fertility. For full returns, both fur quality and fertility must be kept high.

The market

At present there is virtually no market for chinchilla pelts in the United Kingdom. It is true that individual pelts can be sold, but the majority of dealings on the London markets have been in North American pelts for re-export. The industry is, therefore, going through a phase of expansion of breeding stock with a view to an eventual home market. A few very good pelts will fetch £10–£15 apiece, but whether these prices will be maintained, or driven downwards by a great expansion of numbers, is problematical. At present such prices are really indicative of scarcity value. This expansion of breeding stock requires to be very carefully watched and coordinated if the best results are to be obtained. A balance will be necessary between close inbreeding for pelt quality and outbreeding without loss of quality to keep the fertility required to make breeding pay.

It will be readily understood that the next decade may be critical for British chinchilla breeders, and one in which the newcomer to the industry will need all the help and guidance he or she can get. It is safe to say that here, as has already been seen in America and Canada, the industry involves a lot of capital and skill, and by no stretch of imagination can it be described as a get-rich-quick business. Much time and patience are needed and the breeding problems will require very careful study. The chinchilla is, however, a pleasing little animal and does not require a great deal in the way of specialized buildings. Whether or not it pays will depend on the skill of the breeder.

WE APOLOGIZE TO READERS for the delay in the production of this issue, which has been caused by the recent dispute in the printing industry; also for the fact that a separate August issue has had to be abandoned. Every effort is being made to publish the September issue at the normal time.

An adjustment to compensate for the missing issue will be made when readers' subscriptions are renewed.

Year-Round Chrysanthemums

SIDNEY A. SEARLE

Chichester, Sussex

Chrysanthemum flowers can be produced from selected varieties whenever they are wanted, if temperature and day-length are controlled. The grower can make forward selling contracts, and his work is spread evenly over the year.

YEAR-ROUND chrysanthemum production means essentially the regular, planned production of flowers under glass, marketing to a programme on any day of the year. The date on which any particular bed will be cut is known in advance and, since the output of flowers for each week is also known and can normally be relied upon, the grower is able to enter into forward selling contracts. He can remove from his operations much of the uncertainty of commercial horticulture, and he also enjoys the great benefit of an even flow of work throughout the year. Every operation connected with the crop is usually carried out each week—planting, supporting, watering, disbudding, spraying, cutting, packing and marketing. The economies associated with repetition work can therefore be enjoyed.

Controlled production is based on the fact that the chrysanthemum is a short-day plant, and will initiate flower-buds when subjected to 9½ or more hours of continuous darkness within certain temperature limits. To get chrysanthemum plants to flower to a programme in the latitude of the British Isles, it is necessary to shade the plants with black cloth to lengthen the night during the late spring, summer and early autumn, and to give additional light during the autumn, winter and early spring. In the year-round programme, plants are shaded from 20th March to 20th September and given additional light from 10th August to 10th May.

Controlling the day-length

For beds 4 feet wide, which is the recommended width for year-round growing, a single line of 100 watt lamps, 6 feet apart and 4 feet 6 inches above the bed, is found to be satisfactory. The lamps are fixed to the cable (7/.029 t.r.s. twin cable) with festoon-type holders.

The normal lighting periods in the middle of the night are:

	hours
April, May, August and September	2
October and March	3
November and February	4
December and January	5

When bud development and flowering are required under natural long-day conditions, the necessary short days are given by covering the entire bed from 6 p.m. to 7 a.m. with an opaque material, usually black cloth or plastic sheeting. Since the plants need consecutive nights of at least 10½ hours for

bud development, the total period when darkening may be needed extends from March until September.

Temperature

The control of temperature must be superimposed on day-length control for uniform fast growth and flowering of most varieties. Many chrysanthemums will not develop buds, even under short-day conditions, if the temperature is too low. A number of varieties, mainly American spray types, have recently been classified into three temperature groups as:

1. Thermozero varieties, which can initiate and develop their buds in the night temperature range of 50–80°F.
2. Thermopositive varieties, which need a minimum of 60°F for vegetative growth and bud development.
3. Thermonegative varieties, in which bud initiation and early development occur in a temperature range of 50–60°F, although flowering will be delayed if night temperatures of 60°F or above are maintained for the later stages of bud development.

In all three groups a 60°F night temperature is best for vegetative growth and bud development in the early stages—up to the fourth or fifth week of short days.

Response to day-length

The natural flowering dates of mid-season and late-flowering chrysanthemums depend on the rate of flower development under short-day conditions. Most of the American spray varieties and some of the British standard varieties have been classified into "response groups" according to the number of weeks of short-day treatment needed from bud initiation to flowering.

They range from the 8–11-week varieties which flower naturally from mid-October to the end of November, up to the 13- and 14-week varieties which flower naturally in December. It should be noted, however, that this classification is based on a 60° minimum night temperature in latitudes 45–55 deg. north. An 11-week variety may take 13 weeks or more to reach maturity if grown in latitudes north of 55 deg., or in night temperatures lower than 60°F.

Planning the crops

Detailed year-round chrysanthemum programmes can be planned for any suitable situation. Normally all the flowers are grown on single stems. If pinched crops are to be included (thus growing on two stems), the number of cuttings needed will be halved, but two to three weeks of extra time will be required for each crop, and the flower quality may be slightly impaired.

The varieties used in the programme have to be selected for each season of the year. The 8–11-week varieties, with certain exceptions, are classified as "light inefficient", and are usually flowered only from mid-March to the end of November. The "light efficient" varieties of the 12-, 13- and 14-week response groups are flowered during the remaining months of the year when light is limiting. However, flowering in certain varieties of the 13- and 14-

week response groups may be delayed by high temperatures (above 60°F) during the early autumn months, and they should not be timed to flower before Christmas. The colour range used, and the planting distances, are also varied with the season, but the main consideration is the market requirement.

Short stem disbuds are sometimes grown in the year-round programme. With this crop, 10-week varieties are normally used, the flowers being smaller than those of the standards and on shorter stems. The crop is grown by planting the cuttings 6 inches square, pinching from one to three weeks later according to season, and allowing two or three blooms per plant. One to three weeks of long-day treatment are given after the pinch, depending on the time of year. Spray varieties disbudded and treated in this way will flower at least a week earlier than when grown as sprays.

A typical year-round cropping programme for a 16-bed unit of single-stem flowers will produce three complete crops from the same ground, and flowers are cut every week. An extract from such a programme is shown below.

		Lights		Shade		Weeks		
Bed	Plant date	On	Off	Start	Stop	to crop	Re-sponse	Flower date
1	19.5.59	No	—	9.6.59	(a)	13	10	18.8.59
	25.8.59	25.8.59	15.9.59	15.9.59	30.9.59	16	13	15.12.59
	29.12.59	29.12.59	2.2.60	20.3.60	(a)	16	11	19.4.60
	26.4.60	26.4.60	12.5.60	17.5.60	(a)	13	10	26.7.60
2	19.5.59	No	—	9.6.59	(a)	13	10	18.8.59
	1.9.59	1.9.59	22.9.59	22.9.59	30.9.59	16	13	22.12.59
	5.1.60	5.1.60	16.2.60	20.3.60	(a)	16	10	26.4.60
	3.5.60	3.5.60	12.5.60	24.5.60	(a)	13	10	2.8.60
3	26.5.59	No	—	16.6.59	(a)	13	10	25.8.59
	8.9.59	8.9.59	6.10.59	No	—	18	14	12.1.60
	19.1.60	19.1.60	23.2.60	20.3.60	(a)	15	10	3.5.60
	10.5.60	No	—	31.5.60	(a)	13	10	9.8.60
4	2.6.59	No	—	23.6.59	(a)	13	10	1.9.59
	15.9.59	15.9.59	13.10.59	No	—	18	14	19.1.60
	26.1.60	26.1.60	1.3.60	20.3.60	(a)	15	10	10.5.60
	17.5.60	No	—	7.6.60	(a)	13	10	16.8.60

(a) Stop shade when buds show colour on all plants.

Special aspects of cultivation

To attain the high standard of flower and foliage needed, and to enable flowering to be timed accurately, the crop must be grown under glass throughout the year. Well-built, heated glasshouses are usually found to be suitable in southern England. In other parts of the country, it would probably be essential to use only sites with a good aspect (a south-east slope may be the best) and having other favourable topographical features.

To achieve the length of stem and flower quality needed, it is essential that the fast-growing varieties used in the year-round programme should never

A disbud crop. Indianapolis White and Indianapolis Pink chrysanthemums grown on single stems, 30 inches long, flowering in April.

Photo reproduced from Searle and Machin, *Chrysanthemums the Year Round*, by permission of Blandford Press Ltd.

Year-round Chrysanthemums (Article on pp. 186–9)

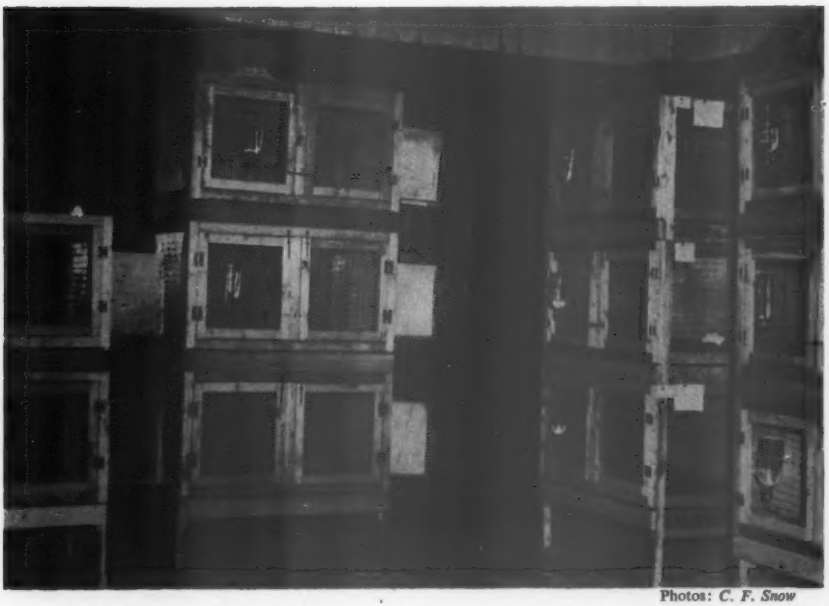
During the winter: these plants are developing their buds in natural short days, when no artificial lighting is needed.

Photos: *Charles Howard and Son Ltd.*

In the early spring, when both shading and artificial lighting are wanted: the curtains used to screen the lighted area from other beds can be seen, as well as the shade cloths over the beds.

Chinchilla Farming in Britain (Article on pp. 182–5)

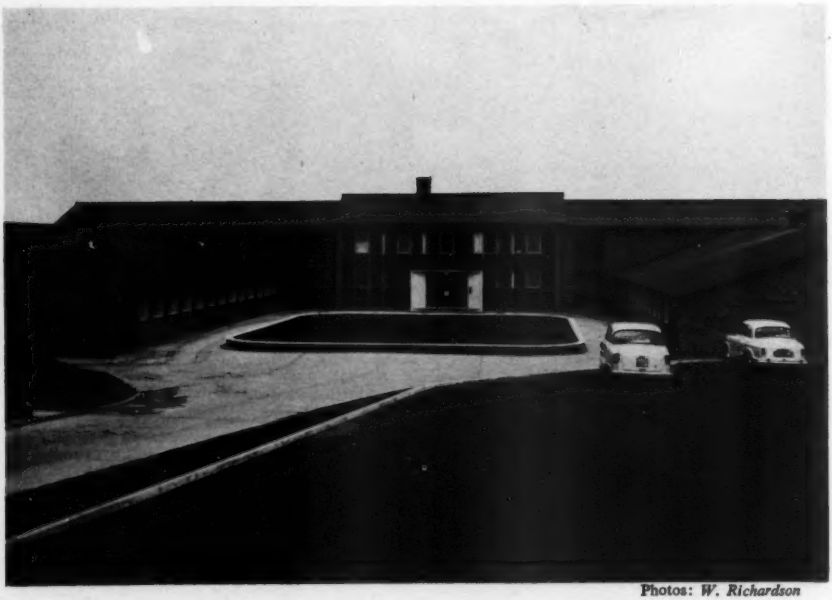
A well-matched breeding pair.



Photos: *C. F. Snow*

Note the nest-boxes and record cards on the sides of the cages.

The Board's headquarters at Letchworth.



Photos: *W. Richardson*

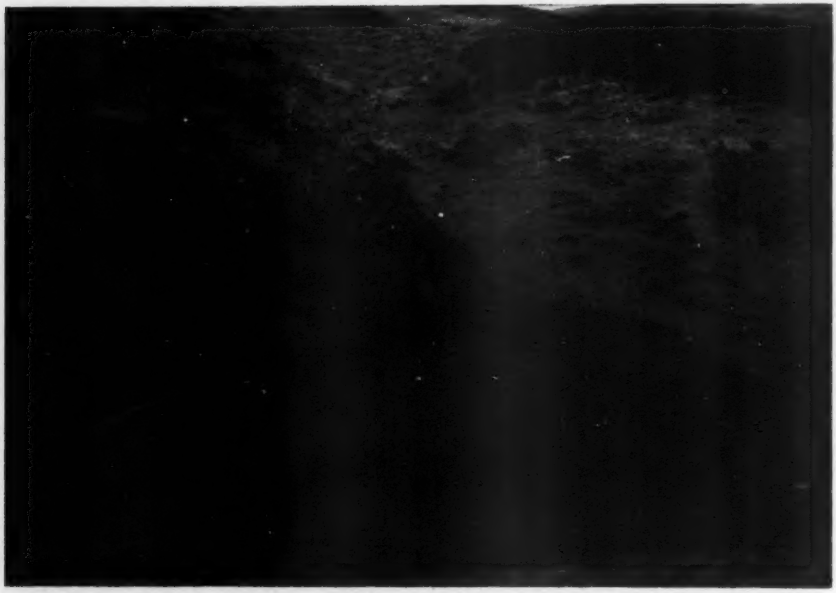
The Corsham station.

esting (Article on pp. 174–6)

General view of a wing at one of the Board's modern stations.

Photos: *W. Richardson*

Feed is measured into the bins for each pig.



Fluke snails can propagate and contaminate pasture with fluke cysts from such areas as: a hill flush—

—a badly-drained valley bottom—

n W rticle on pp. 170–3)

—damp, rushy patches in a lowland field—

—areas of local flooding.

be short of water. With clean, healthy cuttings, the crop is grown without a check, and such troubles as mildew are very rarely seen in the short time the plants are in the ground—13 weeks in the summer and up to 19 weeks for crops in the winter.

It is usual to water and liquid feed automatically, for example by trickle irrigation. For supporting the plants, a framework with netting is left permanently in position, being raised and lowered as necessary on the arches used to carry the lights and black cloth.

At least once a year the beds should be steamed as they become vacant. The punctured hose and polythene sheet method effectively sterilizes ground beds from the surface to a depth of about 6 inches, which appears to be quite adequate for the shallow-rooted chrysanthemum, and can be used without interrupting the programme. The beds are given a dressing of peat or manure, and any fertilizer shown by analysis to be needed. They are then ready for the following year's cropping.

The heating system

The heating system must be capable of holding a night temperature of about 60°F whenever that may be necessary during the winter. In very cold spells, which are generally short, temperatures much below 60°F for a few days are found to do little harm, and at all times the crop is improved if the temperature at night is gradually reduced to 50°F as the time for flowering approaches.

If the unit to be used consists of a bed or number of beds in a glasshouse or block of houses, considerable economy in heating costs will follow if each unit can be separately heated. Where each unit is a complete glasshouse, this matter is greatly simplified, and the 60°F needed at planting time and until the flower-bud is initiated and has started development can be given. This temperature is then steadily reduced by some two degrees a week and held at 50°F in the final stages. Where beds are used as the unit, a satisfactory arrangement is to have a separately-valved heating loop round each bed, or at least to have the heating pipes running parallel to the beds, so that some variation of temperature across the house is possible.

During the summer months, little or no pipe heat will be necessary to maintain the ideal night temperatures for each stage of growth. Indeed, the problem is then to prevent temperatures rising too high. At this season, varieties are chosen which perform satisfactorily under high night temperatures.

Economic factors

The cost of cable, lamp-holders and lamps for 100-feet length of 4-feet bed at the present time is about £4. To this has to be added the cost of any switch-gear needed in the houses and, since the lights are used only in the middle of the night, it is usual to have a time-switch.

Problems of Welsh Agriculture (Article on pp. 166–70)

These small farms in Caernarvonshire, 800–900 feet above sea level, are typical of Welsh agriculture.

Photo: *Geoff. Charles*

The cost of the material used for darkening varies from about £3 to £20 for a 100-feet length of 4-feet bed, the cheapest material being 150-gauge black polythene sheeting. The higher-priced cloth is probably the more economical, owing to its better lasting qualities; it should last at least five years. Darkening can be used in winter to conserve heat at night where the beds are separately piped, and to screen plants in natural short days from those under lights.

Arch supports are needed at intervals along the bed to carry the electric cable, and to take the wires used to carry the darkening material and the netting supporting the plants.

In a year-round programme, approximately one-third of the units will be under lights in winter, so that the electrical equipment can be moved from unit to unit as growth progresses. Similarly with darkening, no more than half the beds need to be covered at any one time.

In short, year-round chrysanthemum production demands good glasshouses, well sited and well equipped. The crop must be grown with precision throughout, but the complicated technique does not necessarily have to be mastered by the grower. The specialist propagator who supplies the cuttings also prepares the detailed programme giving the dates for lighting, shading and other operations, and usually advises generally on the culture of the crop.

By enabling chrysanthemum flowers to be produced with certainty to a programme round the year, this method of growing has created a new interest in commercial horticulture and has undoubtedly come to stay.

Lettuce Varieties for Soil-warmed Hotbeds

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This article compares the quality, size and earliness over a number of years of ten lettuce varieties grown on trial in soil-warmed hotbeds.

DURING the Electrical Research Association's original work with soil-warmed hotbeds,[1] and in later work with higher electrical loadings,[2] the variety of lettuce used was black-seeded Gotte à Forcer, with Cheshunt Early Ball recommended as an alternative. These have been very successful over the years, but Gotte à Forcer has not been popular in some commercial circles as it compares unfavourably in size with later-developing varieties like May Queen. In view of this, the Electrical Research Association followed up with a variety trial to assess the merits of other possible varieties. The full results have been published in their Technical Report,[3] of which this article is a summary. The trial was carried out over a number of seasons, including two which were quite severe, from 1951 to 1955, using the same

set of soil-warmed, single-span Dutch light frames as had been used in the earlier work. The daily dosage of heat for all of them was standardized at 45 watt-hours per square foot, applied for twelve hours from 7.0 p.m., and the horticultural procedure was the same as that recommended earlier. The plants were set eight inches apart, on the square, just before Christmas each season.

Varieties tested

Ten varieties in all were tested, but not more than six during any one season. They were Gotte à Forcer, Cheshunt Early Ball, Cheshunt Early Giant, Cheshunt 5b, Attractie, May Queen, Early French Frame, Blackpool, Loos Tennis Ball and Gotte à Graine Blanche (white-seeded Gotte).

The lettuces were cut and weighed individually when they had reached a size suitable for the commercial market—that is to say, when they had developed hearts which were obviously firm when tested with the back of the hand. The date on which the first lettuces were cut varied from 18th to 31st March, according to season, the average being 25th March.

Gotte à Forcer, Cheshunt Early Ball and Cheshunt 5b were grown during each of the three seasons and all were satisfactory. Cheshunt Early Giant, Attractie and May Queen all failed to produce good lettuces in the first season's trial, and were replaced in the second year by Blackpool, Early French Frame and Loos Tennis Ball. Both Blackpool and Early French Frame were very variable in quality and were grown again in the third season, but Loos Tennis Ball failed to produce acceptable heads. It was replaced by Gotte à Graine Blanche in the third year.

In the final year, Gotte à Graine Blanche was compared with Gotte à Forcer to confirm the previous season's results.

Response

Of the varieties tested, six proved to be quite unsuitable for the close conditions and low light intensities prevailing in hotbeds early in the year and three were as good as, or better than, Gotte à Forcer.

Cheshunt Early Giant is a well-established glasshouse lettuce, but it is not adaptable to hotbed conditions under which it gives a poor quality head. Attractie is said to do well under cloches, but certainly does not like hotbed conditions. It produced very large heads and obviously needs more head-room than is afforded in a frame hotbed. The quality was poor, there was no firm heart, but a high proportion of useless outer leaves. May Queen, a standard cold-frame lettuce, also produced poor quality heads in the hotbeds, with a high proportion of useless outer leaves and a loose centre. Blackpool and Early French Frame had similar characteristics, cropping slightly earlier than Gotte à Forcer during their first season but very much later in the following year. During both seasons their response was erratic; the best of the heads were quite as good as those of Gotte à Forcer, but there was a high proportion of poor heads. Loos Tennis Ball failed to produce satisfactory lettuces and is unsuited to hotbed conditions.

The following varieties were quite suitable, but some matured rather earlier than others. Gotte à Forcer has hitherto been the standard hotbed

variety, against which the other varieties must be judged. It provides excellent lettuces with good hearts, although it is usually regarded by the market as being too small. Over the four seasons the average weight per head varied from 5¼ to 7¼ oz. This variety has, however, shown up very poorly compared with the others on the count of earliness. It is clearly the latest of the four best varieties. Gotte à Graine Blanche was found to be similar in all respects to Gotte à Forcer. During its first trial it started rather earlier, but later in the season fell a little behind Gotte à Forcer; in its second year it was very slightly earlier. Cheshunt Early Ball is usually recommended as an alternative to Gotte à Forcer. The trial has shown it to be of good quality and, on average, about a week earlier than Gotte à Forcer. Cheshunt 5b, a glasshouse lettuce which has been introduced since the initial development of soil-warmed hotbeds, has given very good results under these conditions. The quality suffered slightly in the severe winter of the third season, and it has produced slightly lighter heads than Gotte à Forcer, but it has been the earliest of the varieties tested. Only during the third season, when it was checked by severe weather, was it later than Cheshunt Early Ball.

Of the ten varieties tried, only three proved to be suitable alternatives to Gotte à Forcer. These were Gotte à Graine Blanche, which was similar to Gotte à Forcer in almost every respect; Cheshunt Early Ball, which was very much earlier; and Cheshunt 5b, which was the earliest of all except during a very severe winter, to which it appears slightly more susceptible than the other three.

Acknowledgment is made to the Ministry of Agriculture, Fisheries and Food for their financial support of this investigation.

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3. Lettuce Varieties for Soil-warmed Hotbeds. A. E. CANHAM. *Electrical Research Association Technical Report* W/T 35, 1958. Price 9*s*. (9*s*. 3*d*. by post).

The two priced publications can be obtained from the British Electrical and Allied Industries Research Association, Thorncroft Manor, Dorking Road, Leatherhead, Surrey.

Silage-making with Forage Harvesters

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The high output of modern forage harvesters can be largely wasted if the rest of the job is not well organized. A recent N.A.A.S. report shows how an efficient system can be achieved for a wide range of conditions.

THE introduction of high-output forage harvesters on to British farms has brought a welcome speeding up of the actual field work of silage-making, but it has shown some weaknesses in the organization of the rest of the operation on a number of farms. The N.A.A.S. therefore made detailed studies on 31 farms during 1958, to obtain a basis for sound advice on how best to organize the whole operation of silage-making using a forage harvester.

The information gathered in these studies is analysed in N.A.A.S. Technical Report No. 11. Previous studies of silage-making methods have included the use of such machines as green-crop loaders, balers and buck-rakes, but it was not until the 1955 investigation that some early types of forage harvester were used, so that field work often limited the overall rate of work on many of the farms studied. Nevertheless, the fact that the average time taken in cutting, loading and ensiling a ton of green material fell from 149 man-minutes in 1948 to 91 in 1955, and 36 in the 1958 study, is a striking illustration of the labour-saving potential of a machine which can use all the power of the operating tractor.

The average loading rate (not to be confused with overall ensiling rates) for all 31 harvesters investigated in 1958 was 8·7 tons an hour, and the average crop yield was very high at 8·6 tons an acre.

Work in the field

The heavy crops of 1958 meant that small forage harvesters with a 40-inch rotor provided a full load for the tractors used (mainly modern diesels of 35 or 37 maximum belt horse-power), and there seems to be little point in using harvesters with a wider cut, except where more powerful tractors are available, or in a very light crop where forward speed is a limiting factor.

A comparison was made between rear-attached direct-throw harvesters towing trailers directly behind, and side-cut machines which can either tow a trailer or deliver into one drawn alongside. It looks as if, except under very difficult operating conditions or in very heavy crops, there is little advantage in towing a trailer alongside; against the small gain in output (about 2 tons an hour) must be set the necessity for providing an extra tractor and man.

The investigation showed that where a continuous high output is the aim, certain details of the equipment must be carefully considered; such things as smooth-sided trailers with quick-acting tipping mechanisms, matched trailers and efficient hitches all contributed significantly to quick turn-round of trailers and reduced waiting time by the harvester.

Transport times for various distances from field centre to silo were recorded, and used to calculate the approximate maximum distances at which different transport systems keep the harvester fully occupied, at various loading rates and harvester outputs. Standard hitching and unhitching and tipping times are allowed wherever they apply. The results of these calculations on a particular transport system were:

System	Load (*tons*)	Loading rate (*tons/hour*)	Maximum transport distance at which harvester fully occupied
			yd
2 towed trailers and 1 transport driver	1	4	1,320
		8	440
		12	100
	2	4	3,960
		8	1,320
		12	440
	3	4	6,160
		8	2,200
		12	1,320

NOTE: Three minutes allowed for hitching towed trailers. Distance reckoned from centre of field to silo. Three minutes allowed for tipping trailers at silo.

Time spent at the silo

The time (in man-minutes) taken to ensile a ton of material from its arrival at the silo varied enormously from farm to farm. The advantages and shortcomings of the different methods studied were assessed. Methods included tipping trailer loads near the silo and loading the silo with a buck-rake or manure fork on a front loader, tipping trailers drawn over the silo, hand-forking to elevator and using a silage blower.

The use of a short, thin-tined buck-rake or front-mounted manure fork by a skilful operator on a suitable silo proved to be one of the most effective methods studied, and has the added advantage that the cost of such simple mechanical aids is low. If loads are dumped near the pit, ensiling can proceed independently of the harvester, and it is possible to work with only one man.

Tipping trailers drawn over the silo work effectively, but the danger of bogging down in the silo is always present, and a good deal of hand-work is often required. The provision of reasonably priced, multi-purpose, self-emptying spreader trailers would be a logical development of this method.

A multi-purpose elevator with a positive mechanical feed and swivelling delivery might well cure some of the defects of the fork-to-elevator system, which was the least efficient of those studied.

The advantages of a silage blower were reported on one farm, where silage was made in an open clamp at a settled height of fourteen feet.

Choice of twelve systems

The report makes use of the information to draw up twelve systems of silage-making, involving the use of from one to five men and different combinations of equipment. Some of the systems require the development of

new or improved machinery, and although the alternatives proposed are by no means exhaustive, enough information is provided to enable efficient systems to be worked out for most farmers making silage with a forage harvester.

The appendix to the report briefly discusses quality and economic aspects. Silage quality, as far as it could be assessed, was satisfactory; this is at least as important as efficiency in the use of labour.

Theoretical costings suggest that where over 200 tons of silage are made in a year, the use of a forage harvester is more economic than a buck-rake and a mower, but it should be remembered that such calculations do not include such considerations as increased rate of ensiling and possible improvements in silage quality with the lacerated or chopped material produced by a forage harvester.

The Slatted-floor Henhouse

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Mr. Evans considers the advantages of slatted floors over deep litter, and reports the results of recent trials with a slatted-floor henhouse.

THE progressive poultry-keeper is always seeking new means of reducing the costs of egg production. Strong competition and falling returns make such a search imperative. Over the last few decades, much has been achieved through an ever-increasing intensification. In certain instances, new developments, the germ of which was often imported from other countries, have led to radical changes in the organization of poultry production. The deep-litter system, which has been so widely adopted for the intensive housing of both layers and other stock, was introduced into the United Kingdom towards the end of 1947, following the visit of a fact-finding mission to the U.S.A. In other instances, an old idea has found profitable reapplication in a new setting. Such is the case with the slatted-floor henhouse.

Methods of housing hens have undergone both modification and fundamental change within a generation. Designs have evolved from the traditional stackyard and free-range system, through yarded systems, arks and various movable henhouses to the deep-litter system and the fully mechanized battery. Deep litter continues to be a firm favourite. The whole concept underlying the system is intensified production at low capital cost. In 1947, when building materials were scarce and prohibitively dear, a cheap method of housing birds in existing buildings was most welcome. An intensity of one bird to 5 sq. feet was at first considered satisfactory. Among the first conversions for this purpose was an old machinery shed at the Experimental Husbandry Farm at Trawscoed, near Aberystwyth, where adaptation and all internal fittings cost about 5*s*. per bird.

Boost for deep litter

When animal feedingstuffs were derationed in 1952 the possibilities of the new system were soon appreciated and, under the stimulus of an expanding market, the deep-litter system was applied to a wide variety of conditions up and down the country. Many refinements were suggested, and soon the simplicity of the system, the ease of mechanization and almost unlimited scope for expansion ensured a strong following. The system proved too keen a competitor for laying cages, which had been considered essential for the successful keeping of laying hens. With increasing pressures, particularly of narrowing profit margins, poultry-keepers kept more and more birds upon less and less floor space, and by now the accepted standard is 3 sq. feet per bird.

All new systems bring with them a legacy of troubles. Deep litter was no exception. Crowded houses with bad insulation and poor ventilation provided ideal conditions for the spread of certain respiratory diseases and a consequent drop in egg yields. Much improved houses were soon built, incorporating improvements in insulation and provisions for good ventilation. These modifications increased the cost of housing, and the laying cage came back into the competitive fray. Manufacturers introduced both twin and multiple cages, coupled with automatic feeding and cleaning devices, in an effort to reduce unit housing costs. In consequence, the cost of housing laying hens on deep litter is virtually the same as under the cage system. However, in many cases the cost of housing an economic unit of 300 hens is beyond the financial resources of the small farmer.

Advantages of slatted floors

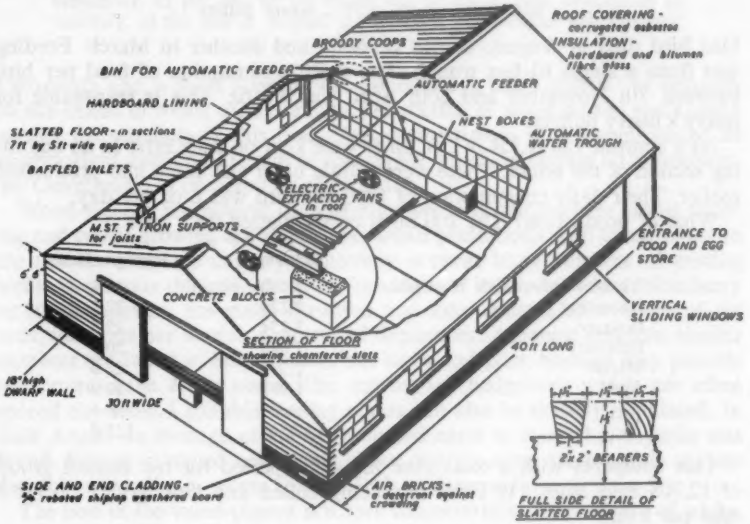
The slatted-floor henhouse was first used, for hens on range, in 1931. It has been used in the rearing of growing stock for nearly thirty years, and is today being recommended once more in the intensive management of laying hens. Its advantages over deep litter are worth enumerating. The capital cost per bird on slatted floors is some 13*s*. below that for similar birds on deep litter. This is due to the amazing intensity in which the birds can be kept—as high as one bird to 1½ sq. feet—and even higher intensities are being suggested in certain quarters. The slatted floors are relatively cheap, simple to maintain, and not subject to heavy depreciation or replacement costs. Moreover, because they can quickly be removed, the building can readily be made available for other uses.

No litter is required. This is a significant consideration, particularly where litter is difficult to obtain—and in all areas it is costly to buy and to handle. Birds are freer from intestinal parasities because they are unable to scratch in litter. Evidence is accumulating that, in consequence of this, birds are heavier at any given time than under deep litter. The limiting of activity to the minimum reduces the demand for energy foods, and so reduces food costs per bird. Eggs are cleaner, because the hens' feet are kept cleaner. Because birds will not nest on the slats, there are fewer floor eggs; there is also less broodiness.

Owing to the nature of the floor, overcrowding at roosting and feeding times is avoided. When properly planned and well constructed, such houses

need cleaning only once a year. Studies in California have shown that the daily "chore time" is also less than under conventional housing systems. If mechanical feeding is also used, the labour demand is the lowest yet achieved. Vermin control is simplified, in that baits can be placed out of reach of the stock.

The disadvantages of the system are that the lice problem is accentuated, debeaking is a necessity, and culling is doubly difficult due to the concentration of stocking. A vaporizer or a trough of dry sand with delousing powder could be installed with advantage.



The floors are made and laid in sections on corner supports which are 24 inches above ground level. The slats should be planed smooth, and be free from knots, to facilitate cleaning. Each slat should be about $1\frac{1}{2} \times 1\frac{1}{2}$ inches, chamfered to 1 inch at the base, and laid on 2×2-inch bearers resting on brick supports. A distance of $1\frac{1}{2}$–$1\frac{3}{4}$ inches between the slats is recommended.

Wherever possible, roll-away nests and a mechanical feeder should be installed. Broody coops should be close by the nests. These introductions ease the labour demand, though a daily inspection of the flock from within the house is still necessary.

Recent trials

Recent trials with a slatted-floor house have been run on the holding of Mr. Frank Williams, The Croft, Goytre, in Monmouthshire. One hundred and one R.I.R. × L.S. pullets, hatched the first week in April 1958, were reared on range from ten to eighteen weeks of age and then housed in a section of a deep-litter house. Laying began at the end of August. Artificial

light was given from early September (dusk to 10.0 p.m.). Slats were erected in half this 18×20-feet house in mid-October, to accustom the pullets to the new floor. By 7th November the whole floor was slatted. During the first ten days a few eggs were laid on the slats, but subsequently this rarely happened. Until the 26th May there were no broodies. Unusually, the pullets were not debeaked. The feeding policy was rather unconventional, and certainly wasteful in labour. The feeding time-table was:

8.00 a.m.	10 lb layers' pellets
11.30 a.m.	8 „ mash (fed wet)
5.30 p.m.	8 „ mash (fed wet)
10.00 p.m.	10 „ layers' pellets

One bird died in August, one in October, and another in March. Feeding was from a single 6½-feet trough. The daily consumption of food per bird between 7th November and 30th April was 5·3 oz. This is reasonable for heavy×heavy pullets.

As a control, 120 R.I.R.×L.S. birds were kept on deep litter in an adjoining section of the house. These were a little older and came into production earlier. Their daily consumption of food per bird was 6 oz per day.

What of production? The 100 birds on the slatted floor gave:

	Total eggs	Eggs per bird
7th November–30th November	1,732	17·3
December	2,223	22·2
January	2,254	22·5
February	2,088	20·9
March	2,275	22·8
April	1,991	19·9
	12,563	125·6

This compares with a total over the same period for the control group of 12,708 eggs from 110 birds (six being culled and four dying), or 115.5 eggs per bird.

Colorado Beetle in 1958

Twenty Colorado beetles were found in 1958; fifteen on or associated with vegetable produce and five on transport. This is relatively few compared with 1957 (48) and 1956 (51). No breeding colony has been found since 1952.

Three beetles were associated with French imports—one on parsley, one on endive and one in grain; three were found among potatoes from Belgium; four on onions and two on potatoes from Spain. One arrived in a mixed cargo of vegetables from Holland, and one each in potatoes from Portugal and Italy. Five single beetles, which could not be associated with any definite produce or country, were found as follows: at Portland Dock; on a lifebuoy locker on a vessel from South America which had called at Spanish ports; in a hold of a ship calling at Antwerp and Rotterdam; on the A.12 road at Mountnessing, Essex; and on a boat sailing from New York and calling at Reykjavik, Bremerhaven and La Pallice. One note of special interest that emerged from the reports for this year was of the beetle on French endive found in Covent Garden on 10th November. This was the first ever recorded on produce imported during November.

The Ministry greatly appreciates the support that the public, the police and others have given to the Colorado beetle campaign. It is still important that any suspected beetle should be reported promptly.

H. W. Janson

Attacking Wood-pigeons in their Nests

R. K. MURTON, B.SC.

Ministry of Agriculture, Fisheries and Food

If wood-pigeon nests are destroyed at the end of July and again in mid-September, 65 per cent of the young will be killed. Nest destruction in mid-July, at the end of August and again in mid-October will kill over 80 per cent of the nestlings.

Two years ago, a short account was published in this JOURNAL[1] of research on the extent to which the systematic destruction of wood-pigeon nests could control the numbers of this bird. Nest destruction is now recommended as an important ancillary method of control for which, in certain circumstances, the Government is prepared to pay a grant.

Wood-pigeons are present in large numbers in districts where arable farming and cereal growing are important. Small plantations with dense cover in the middle of arable country commonly support large numbers of nesting birds. Deciduous thickets, about 25 feet high, of hazel, hawthorn, elderberry or similar shrubs, are much favoured and may contain an average of six occupied nests per acre in August and September. Amongst conifers, similar numbers are found in Sitka spruce, but larch and pine, because they provide less cover, have fewer nests. The untrimmed hedgerows which are often spaced out around suitable feeding places can also be densely populated; in East Anglia an average of twelve occupied nests in every 1,500 yards was found. Fewest occupied nests, only about one per acre, are found in mature deciduous woodland, where there is little undergrowth.

The nest of the wood-pigeon is a very characteristic flat platform of sticks, varying in size from 7–9 inches across, placed in a fork or in ivy growing against the main trunk of a tree. The height varies with the habitat and the cover, but is usually between 15 and 25 feet. Nests can be found so easily that their systematic destruction is relatively simple by taking a planned walk through the nesting places, working in strips if the area is large. Every nest that can be found should be destroyed; in our experiments we used a jointed aluminium pole with a hook and probe fixed to one end.

An important aspect of nest destruction is that the operation can be limited to a short period in the year. Seventy per cent of all young wood-pigeons leave their nests in August and September, which is the time when most adults are nesting. The factors responsible are described elsewhere,[2] but it is mainly during these two months that an abundant supply of cereals can provide suitable food for the successful growth of the nestlings. About ten per cent of all the young leave the nest before the beginning of August, and most of the other 20 per cent leave during October.

Preventing the young from flying

To prevent the majority of these young from flying, nest destruction should

begin towards the end of July. If nests were destroyed often enough, breeding could be completely prevented, but this would be very expensive. The total number of visits to a site has been reduced to the minimum consistent with efficiency. Thus with only two nest destruction operations, 65 per cent of the young can be prevented from leaving their nests, and with three operations over 80 per cent reduction can be achieved. The interval between any two operations is very important. When a nest has been destroyed, the birds immediately start rebuilding. This takes a few days; eggs are then laid and hatch after eighteen days of incubation, and the young remain in the nest at least twenty days before they can fly. Altogether it is exactly six weeks before it is necessary to visit the nesting places again. If the interval between visits is too long before nest destruction is repeated, many young will have flown. If it is too short, there will be a longer period after the completion of the second operation in which the birds could still rear young.

Many nests will be found to be empty; some will contain eggs, and only a small proportion will have young. The value of the operation cannot be judged by the total number of eggs and young destroyed during any one period. The essential feature is that the breeding cycle is interrupted, and the *potential* production of young reduced. Up to the end of July, natural factors prevent most young from being reared. The successive nest destructions prevent the repeat layings from succeeding, and afterwards the natural end of the breeding season is so close that relatively few birds can repeat successfully. Research has shown that for the best results with two operations, the first should be during the last week of July and first week of August, and the second six weeks later in the middle two weeks of September. If three operations are carried out the timing should be changed slightly. In this case, the first should be in the middle two weeks of July, the second six weeks later, at the end of August and beginning of September, and the third six weeks later again, in the middle two weeks of October. Nest destruction outside the recommended periods is useless.

Action through Rabbit Clearance Societies

For nest destruction to be of value, wide and substantial support must be forthcoming from farmers and others affected by wood-pigeons. To encourage this, it has been decided to recommend co-operative action through Rabbit Clearance Societies. By this means it is hoped to achieve block control over whole areas, rather than random control in small areas scattered throughout the country. Fortunately, the time for nest destruction coincides with one of the slacker periods for rabbit control, so that men should be free to do this work.

On large estates there will probably be more nesting sites than can be covered by one man, using the two operation technique. However, it is possible for one man working to a time-table to deal with eighty acres of nesting habitat and to be employed for ten weeks. Such a time-table has been prepared and involves splitting the nesting area into four sites, which are treated in consecutive weeks from the second week of July to the first week of August. Each is dealt with twice more at six-weekly intervals, but all the work is condensed into two weeks for the third visit, as at this time (mid-October) nests are few and considerably less time is needed. Societies carrying

out nest destruction in this way could employ casual labour for the season, if the amount of nesting cover makes this necessary. To encourage the systematic and organized destruction of wood-pigeon nests in this way, the Ministry will pay a grant of half the cost to Rabbit Clearance Societies who carry out such work on behalf of their members. Details of this scheme have been made public.*

Very little immigration

Many farmers believe that large flocks of wood-pigeons arrive in this country each winter from Scandinavia. Much research has been devoted to discovering the extent of these movements, because nest destruction or many other control methods would be nullified if many pigeons were migrants. Our research has shown that in fact very few wood-pigeons arrive in this country from abroad. During the summer months the birds are scattered throughout the breeding places. Food is abundant and widespread, and they can collect enough in a short time over a wide area. Large feeding concentrations, which are seen in the winter months when food is scarce and the days are short, are therefore not found in summer. There is, however, a small rise in numbers during the winter, due to the appearance of birds reared during the previous breeding season. These are first noticed in October, and are smaller and darker and at first lack the white neck mark of the adults. It is these which are often mistaken for foreign birds. Juveniles are killed more easily than adults and up to the time of the organized shoots in March, a higher proportion are shot. Nest destruction removes these young, which should be killed as quickly and humanely as possible, before they can do damage during the winter months.

Nests are destroyed when most other birds have finished nesting, so there is little risk of disturbing protected species. Furthermore, the method calls for little skill and no expensive equipment, and can be carried out with no risk to game birds or to normal farm work.

References

1. Wood-pigeon Control by Nest Destruction. R. K. MURTON. *Agriculture*, 1957, **64**, 198–200.
2. The Breeding of Wood-pigeon Populations. R. K. MURTON. *Bird Study*, 1958, **5**, 157–83.

* A leaflet can be obtained from the Ministry's local offices.

Farming in Oxfordshire: 1789-1939

NIGEL HARVEY

THE Oxfordshire region is very typical of the agricultural landscape of southern England. It is also typical of much of its historical development, as Mr. John Higgs shows in the current issue of the Journal of the Royal Agricultural Society.

He begins his story with the enclosures which made possible the establishment of the new farming. This agrarian revolution, which recast our farming system, was followed by a technical revolution, instanced by tile pipes, imported plant foods and factory-built implements, which re-equipped it. Thus was created the famous high farming, which was one of the major industrial triumphs of our race.

Then came the age of competition. New farmlands overseas, new methods of transport and of food-preservation combined to rob the British farmer of his monopoly of the home market, and within a decade the high farming went down into history, hopelessly defeated. The arable acreage shrank, the folded flocks decreased, the fixed equipment of the farm decayed, clayland reverted to scrub. Gradually and painfully, however, farmers evolved systems capable of holding their own under the new conditions. In particular, many turned to dairying. The cowhouse was one of the symbols of the new agricultural order.

It was not, however, the only one. Perhaps even more significant were the new centres of agricultural education, for it is above all in the standard of general and technical knowledge that the farmer of today differs from his forefathers. Equally significant was the manner of their development, for agricultural education was one of the main concerns of the new Board of Agriculture which was established in 1889. The farmer, like his farm, was losing his traditional self-sufficiency and, in the last generation, the primary theme of agricultural history in this area as elsewhere has been the adoption by the farmer of knowledge and equipment developed outside the farming economy.

Mr. Higgs has admirably summarized a considerable and varied literature. But he could have greatly improved the quality of his story by using local evidences of the type which do not always find their way into the standard books. For example, the enclosures are a long way behind us. Yet there are villagers within walking distance of Oxford who can recall scraps of their grandfathers' tales of the routine of the open fields and the last enclosure in the county. Again, he could have strengthened his reference to "the men who had earned their money in the world of commerce" by quoting that small corner of Northern Oxfordshire where three such text-book representatives of the economic times as Boulton the engineer, Brassey the railway-builder and Garratt the tea-merchant chose to found their estates. But perhaps it is a little unfair to complain of the lack of a particular local flavour, especially as the author has offered us such a generous proportion of a quart in his literary pint pot.

The Bath and West Show, 1959

PROMPTLY at nine o'clock on the morning of June 3rd, a scarlet-clad figure stepped into the main ring, raised his trumpet to his lips and sounded a fanfare. The Bath and West Show 1959 was open. Although Yeovil is almost in the centre of the Society's area in the West Country, the Bath and West Show has only twice previously been held there. The last time was in 1932. This year's Show, on a site of 73 acres in tree-studded Barwick Park, opened in brilliant sunshine under blue skies. This was a good augury, but for many West Country farmers the counter-attraction of haymaking proved too much, so that the attendance figure on the first day was less than expected. On the following three days the all familiar sound (in the West Country) of pattering rain on canvas was heard too frequently. All hope of a six-figure "gate" for the four days was abandoned—65,000, compared with 106,000 at Plymouth last year.

More cattle were seen at this year's show than at any post-war Bath and West Show, apart from 1950, and all breeds were well represented. Galloways, introduced for the first time, attracted 33 entries. The strength of West of England Ayrshire herds was demonstrated by Mr. John Bourne of Moreton-in-the-Marsh, Glos, who won the championship for the third year in succession. There was a record entry of pigs—447, compared with 347 last year.

The long avenues of brightly coloured farm implements and machinery, gaily attractive even in the rain, were dominated by a spectacular feature showing a tractor balanced vertically, and without apparent support, on the index finger of a huge hand made from fibre-glass.

"The Barley Mow"—the malting barley exhibit organized by the Institute of Brewing—was well visited. In spite of its title, the exhibit was strictly educational; there was no free beer! Its object was to help farmers select suitable barley varieties and to give advice on growing and harvesting, the whole process from seed to beer being effectively portrayed.

A working demonstration of cheese-making in a large building well designed by the Show Society attracted a good deal of attention. Running commentaries on the processes involved were given by N.A.A.S. officers. Whey butter-making was also demonstrated.

"At the Farmer's Service", the Ministry of Agriculture's exhibit, presented a coordinated picture of the various services which can be offered to the farmer, and illustrated how the advisory services are complementary to the financial assistance available. Two exhibits were of particular interest in the south-west—one on farmhouse cheese-making and the other on growing cider apple trees. There were a number of exhibits on more general topics, but one on drainage and water supply perhaps compelled the most interest. This showed two large relief models of the same piece of land, the first illustrating the kind of drainage problem on which advice can be obtained, and the other giving some examples of the type of work for which grants are available. For sheepmen, the N.A.A.S. pointed the way to sound flock feeding and management, concentrating on the fact that since the peak periods of the sheep's nutritional needs do not coincide with the natural peak yields from grassland, the planned treatment of grass and the provision of supplementary feeding need to be carefully studied.

K. R. Aunger

16. Pastoral Durham—Teesdale

ALLAN W. STOBBS, B.SC., M.S.
District Advisory Officer

IN one respect it is unfortunate that both the main east coast railway line and the A.1 trunk road run through the east side of Durham, for travellers through the county get the impression that agricultural activity is limited to the forlorn areas of crops and grass seen striving for survival around colliery spoil heaps. Yet more than two-thirds of Durham's 650,000 acres are devoted to agriculture; the potato crop alone is worth more than £1m.

The Teesdale district occupies the south-west corner of the county. The Tees itself forms the boundary to the south, and the northern edge of the district follows the watershed between the rivers Wear and Tees. In the forty miles from Darlington to the Cumberland border there are 190 sq. miles of as varied farming country as can be found anywhere. It is only in the extreme north-east corner that King Coal has his territorial outposts!

The Tees rises on the slopes of Cross Fell, the highest of the Pennine summits, and for the first ten miles of its course flows through a broad U-shaped valley, the track of the Teesdale glacier. The leisurely flow of the river is interrupted by the doleritic Whin Sill, which causes the magnificent 200-feet cataract at Cauldron Snout and the better-known 70-feet fall at High Force. The floor of the valley is of boulder clay, often overlain with peat, with outcrops of limestone and whinstone prominent on both sides. This upper dale is noted for its rare alpine flora, and in May and June it is popular with botanists looking for spring gentian, birdseye primrose, globe flower, alpine forget-me-not, and many others.

The area is also fascinating for the student of industrial social history, for the progress and fortunes of its people are closely linked with lead. Tradition has it that the Romans worked the surrounding hills, but available records give 1571 as the first reliable date of lead-mining operations. By the latter part of the eighteenth century, most of the mines in the dale were being worked by the London Quaker Lead Company. From then until mining ceased in 1905, the life of the dale was influenced and moulded by this strict but benevolent company.

These mining activities are the cause of many problems in Teesdale today, where most of the farms were originally intended as part-time smallholdings for the lead-miners. The result is a large number of small farms, each with its own set of buildings, competing for the better land in the valley and sharing the unimproved common grazings on the fells above. The parish of Forest and Frith, for instance, lies between 1,200 and 2,000 feet above sea level, has an average annual rainfall of 55 inches, is divided into some sixty holdings and somehow supports a population of 384. Milk production is the mainstay of this area, but unfortunately the native Shorthorn cattle are not

able to provide economically the high level of output required on such small farms. Other dairy breeds are providing a better livelihood.

Most farms have grazing rights on the fells, and the stocks of Swaledale ewes provide a useful supplement to the income from dairy cows. But the management of the commons leaves much to be desired. They are overstocked, inadequately fenced, never limed or slagged, only partially drained and responsible for an alarming increase in the incidence of "staggers" in ewes at lambing time. It is to be hoped that the recent report of the Royal Commission on Common Lands will stimulate some action to correct this deplorable state of affairs.

At the small market town of Middleton-in-Teesdale the characteristics of the upper dale give way to conditions more typical of other similar areas. The farms are rather larger, and milk production becomes of equal importance to stock rearing, or even secondary to it. Again, the native Shorthorn breed is failing to meet present-day requirements, for horned cattle with light hindquarters and a slow rate of fattening are not popular with the feeder. Consequently the move is towards the greater use of Galloway, Aberdeen-Angus, and Hereford bulls, with the retention of heifer calves for breeding.

Swaledale ewes continue to thrive on these lower, rearing farms and are usually crossed with a Teeswater tup. The pure Teeswater may not be everybody's idea of what a sheep should look like, but when used on the Swaledale it leaves a half-bred Masham lamb that is second to none. Hardy, prolific, and an exceptionally good mother, it is the ideal sheep on which to use a Suffolk or Hampshire ram for fat lamb production.

This rearing area continues for ten to fifteen miles east of Middleton, and gradually gives way to arable farming associated with either intensive dairying or fatstock production. From Staindrop and Winston to Darlington the land is some of the most fertile in the county, capable of producing heavy crops of potatoes, barley and spring wheat.

In the nine years I have known the Teesdale district, the most notable advance has been the change in attitude towards silage. In 1950 the talk was of hay and perhaps silage; now it is of silage and hay. From the small dairy farms 1,200 feet up at Forest to the large arable feeding farms only 250 feet above sea level at Piercebridge, silage is quickly becoming the axis around which the entire business of grass production and utilization revolves. In a district where the average annual rainfall is always over thirty inches, the most important crop must of necessity be grass. It has been sadly neglected in the past, but in recent years there has been a growing realization of the importance of grass to the economy of the area. I believe that the future prosperity of Teesdale will lie in the continuation of this trend.

THE MINISTRY'S PUBLICATIONS

Since the list published in the June 1959 issue of AGRICULTURE (p. 155), the undermentioned publications have been issued.

MAJOR PUBLICATIONS

Copies are obtainable at the prices quoted from Government Bookshops or through any bookseller.

BULLETINS

No. 50. Modern Rabbit-Keeping (*Revised*) 4*s.* 6*d.* (4*s.* 10*d.* by post)
A handbook for the domestic rabbit-keeper, giving all the information required for starting and maintaining a rabbitry. The contents include choice of breed, housing, feeding, breeding, preparation of pelts and marketing the meat.

OTHER PUBLICATIONS

Experimental Husbandry No. 4 (*New*) 4*s.* 6*d.* (4*s.* 11*d.* by post)
Contents include: vigour of germination of rubbed and graded sugar beet seed; the effect of the date of planting on the yield of maincrop potatoes; the results of kale trials in recent years; the latest research in haymaking, and rearing dairy heifers on different planes of nutrition.

Manual of Nutrition (*Revised*) 3*s.* 0*d.* (3*s.* 4*d.* by post)
In this manual the complex subject of nutritional science is presented in a simple form. All aspects of the assimilation of food are covered. A scheme of lectures for teachers, suggested demonstrations and a list of recommended books are included.

Oats (*New*) 2*s.* 6*d.* (2*s.* 8*d.* by post)
This fourth booklet in the new series on arable crops covers all aspects of oats cultivation from seed-time to harvest. Farmers, agricultural advisers and students will find it a concise and useful guide.

LEAFLETS

One free copy of Farm Machinery Leaflets may be obtained on application to the Ministry (Publications), Soho Square, London, W.1. Copies beyond this limit must be purchased from Government Bookshops, price 6d. (8d. by post).

FARM MACHINERY LEAFLETS

No. 23. Mechanical Thinning and Gapping of Rowcrops (*New*)

FREE ISSUES

Obtainable only from the Ministry (Publications), Soho Square, London, W.1.

UNNUMBERED LEAFLETS

Farm Safety:
Electricity on the Farm (*New*)
Tree Hauling and Scrubland Clearance (*New*)
Survey of Bee Health and Beekeeping in England and Wales, 1958 (*Revised*)

In Brief

KEW: THE GLORIOUS 2ND OF JUNE

The Queen and Prince Philip spent two hours at the Garden Party held at Kew on 2nd June to mark the bicentenary of the Royal Botanic Gardens. The Royal visitors, amongst whom was also the Princess Royal, were received by Lord Munster, Lord-Lieutenant of Surrey, Mr. John Hare, Minister of Agriculture, Mr. Hugh Molson, Minister of Works, Alderman H. A. Leon, Mayor of Richmond, and Dr. George Taylor, Director of Kew Gardens.

Two commemorative trees were planted—a walnut by the Queen and a dawn redwood by Prince Philip—before the Queen toured part of the Gardens and Prince Philip, escorted by Mr. C. E. Hubbard, visited the scientific exhibition in the Herbarium.

The Queen, escorted by the Minister and Dr. Taylor, drove along the Syon Vista to see the spar of Douglas fir 225 feet long from which the new flagstaff will be made. This fine log was presented by the Government of British Columbia in collaboration with the timber and logging interests, to mark the bicentenary. A similar gift from British Columbia earlier fell victim to a wood-rotting fungus. Her Majesty walked through the Palm House, which had been restored at a cost of £100,000, and the Water Lily House and then rejoined Prince Philip for tea in the Orangery, redecorated and restored to its original purpose.

After tea the Royal visitors met botanists and horticulturists from many parts of the Commonwealth, the Continent and the United States of America. A bouquet of exotic blooms, grown at Kew, was presented to Her Majesty by Sally Brown, the eight-year-old daughter of one of the assistant curators.

This was a day which will be remembered by all who were privileged to be present, as marking not so much the end of an era as the rededication of the scientific work of Kew to a field in which it is already recognized as being pre-eminent.

N.A.A.S. DIRECTOR

Sir Robert Rae, C.B., B.Agr., who has been Director of the National Agricultural Advisory Service since 1948, retired from the public service on 31st July. He has been succeeded by Mr. J. A. McMillan, C.B.E., B.Sc.(Agric.).

LUNGWORM

A new film in colour, *Lungworm in Farm Animals*, has been made by the I.C.I. Film Unit and, because of its simple and direct treatment, will be received enthusiastically by stockowners and vets. The essence of controlling husk is a matter of striking a balance between a calf's natural resistance and the level of pasture infestation by the minute lungworm larvae. This film focuses attention on the very core of the trouble—environment—showing by animated diagrams and micro-photographs how the larvae affect the animal, and then proceeds to discuss methods of prevention and treatment by good husbandry and a new drug, cyanacethydrazide.

The film, which is on 16 mm and runs for 15 minutes, can be borrowed from Imperial Chemical Industries Limited, Imperial Chemical House, Millbank, London, S.W.1.

FOREST OF DEAN REPORT

The Committee set up by the Minister of Agriculture to review the administration of the Forest of Dean, particularly as regards the problems associated with

the grazing of animals, has issued its report (Cmnd. 686).* This area, now covering about 40 square miles, at the junction of the rivers Wye and Severn, was a Royal Forest in the time of Edward the Confessor, who specifically exempted it from taxation, and it subsequently became a favourite hunting ground of the Norman kings. Arising therefrom, certain privileges of commonage and free grazing were accorded to the inhabitants of the Forest, and it is these which the Committee have been considering in the light of present-day conditions.

It is estimated that some 6,000 ewes and 4,000 lambs during the summer roam unattended over large areas of the Forest, in the towns and villages, and on the roads. Not unnaturally there has been growing concern about the extensive damage which these animals have done to gardens and crops; also about the difficulty of identifying the owner of the animals responsible. The Rural Councils of East Dean and West Dean have also had complaints about the fouling of the roads and the prevalence of accidents caused by sheep straying, especially at night.

The Committee say in their report that in their view no person, whether owning or occupying land inside or outside the perambulation of the Forest, has a legally enforceable claim to run sheep on the Forest, and that sheep have been run on the Forest not by legal right but by sufferance of the Crown. But they add that it would not be equitable to ignore the fact that sheep have been grazed in the Forest for many years.

They therefore make a number of recommendations which satisfy their main thesis that the sheep be removed from the Open Forest and roads and also from the towns and villages; the sheep should either be confined to special fenced enclosures or eliminated altogether, subject to certain payments; that a special Commissioner be appointed to compile an appropriate register of sheep owners; that stints should be allotted to each registered grazier which should be enforced after two years (the Committee envisage a stint not exceeding 20 ewes or the equivalent in other stock); and that distinctive marks be allotted to each grazier. The grazing of cattle should be subject to the same form of control as sheep, one cow or bullock being regarded as equivalent to four ewes. The indiscriminate running of pigs in the Open Forest should be brought under control by the registration of owners under similar conditions to those proposed for sheep owners.

SUGAR BEET PULP TO IMPROVE S.N.F.

Experiments in several countries have shown that an adequate energy content in the cow's ration appears to be the major factor in keeping up or improving the level of solids-not-fat. Indeed, rations deficient in energy may seriously reduce the S.N.F. It is also known that the S.N.F. content of milk varies with the season. In most parts of Britain solids-not-fat are comparatively high in October–November and then fall to a minimum in March–April. A rapid rise follows in May–June, followed by a slight decrease in July and August. It is therefore the late winter months in which low S.N.F. milk is most frequently produced.

The Essex Institute of Agriculture have been looking into the question whether the March–April drop in S.N.F. could be wholly or partially prevented by supplementing a winter ration (based on Woodman's standards) with sugar beet pulp. Twenty-two Friesian cows, calved in the Autumn, were paired according to age and one member of each pair was fed 3 lb of sugar beet pulp daily during the sixteen weeks from 1st January. It was found that the S.N.F. content of milk from these cows was maintained through this period. The bulk milk of other cows to whom no supplement was given showed the usual seasonal decline. Unfortu-

* Report of the Forest of Dean Committee, 1958. Forestry Commission. H.M. Stationery Office, price 8*s.* (8*s.* 5*d.* by post).

nately, the feeding supplement produced no comparable increase in yield to offset its cost. Hence, the use of sugar beet pulp in this way seems to be restricted to reducing the incidence of milk poor in S.N.F. A sugar beet pulp supplement may therefore be particularly useful during a winter following a bad summer when a lot of poor quality hay and silage is being fed, to help reduce the incidence of low S.N.F. milk in late winter.

Further work is being carried out to see whether a similar type of supplement may also give an increase in yield.

FARM MACHINERY TRENDS

Evidence from the latest machinery censuses shows that farmers' holdings of the more usual types of cultivating, sowing and haymaking machinery seem to be adequate to their present needs. The number of wheeled tractors of 10 h.p. was up by 11,730 in 1958 (362,210, compared with the 1957 figure of 350,480). This may be due more to the introduction of attractive new models coming on the market from the larger manufacturers than to any general need for additional tractors. These figures also illustrate the rapid changeover from vaporizing oil to diesel fuel. In 1954, when information about fuel types was last collected, diesel engined wheeled tractors accounted for only 12 per cent of the total; in 1958 they amounted to 42 per cent and promise shortly to exceed all other types.

Harvesting machinery also shows a major rise: combines up by 13 per cent to 39,890, pick-up balers by 18 per cent to 51,620, and grain driers of all kinds by 21 per cent to 11,880.

AGRICULTURAL AVIATION

The letters E.A.A.C have begun to appear in agricultural literature. They stand for the European Agricultural Aviation Centre, which has its headquarters at The Hague (address: le v. d. Boschstraat 4). Its Director is Dr. W. J. Maan. This is an independent international non-profit-making organization which aims at promoting the use of aircraft and helicopters in European agriculture and forestry. It was established in July last year under the auspices of the O.E.E.C., and so far the Governments of ten European countries have joined it as members.

The current issue of their new quarterly magazine *Agricultural Aviation* contains articles on the training of agricultural aircraft pilots in Sweden, aerial spraying against late potato blight in the Netherlands, the control of insect pests in a forest area in France, and descriptions of new types of agricultural aircraft and equipment.

An international conference has been arranged for the week, September 14th–19th, at the College of Aeronautics, Cranfield, Beds, registration forms for which may be obtained from the Ministry of Agriculture, Fisheries and Food, Room 218, Great Westminster House, Horseferry Road, S.W.1.

Book Reviews

Grass Productivity. ANDRÉ VOISIN. Crosby Lockwood. 50*s*.

Grass crops hold a pivotal place in crop rotations and produce also the basic food for ruminants. When grass is relied upon to provide animal feed at all seasons of the year, it exhibits unacceptable extremes both as regards quantity and quality. There is large scope in the overall increase of herbage yields from pasture, but there is even greater potential in respect of its fuller and proper use. As in many other Continental countries, farming in France has been based traditionally upon the arable crop and the feeding of arable residues to cattle and sheep. Even so, over half of France is under grass and the livestock industry is of major importance in its agricultural economy. Dr. Voisin's treatise, now in English translation by C. T. M. Herriott, has been written against the background of the small farmer by a man with scientific training. He is a forward thinker, an enthusiast for grass and he writes in a passionate, if not evangelistic, style not unknown among grasslanders in Britain.

The book is wholly refreshing. It is based on common sense born of clear thinking, with a background of travel and experience in the author's native France as well as in other countries of the western world. Since 1946, Dr. Voisin has farmed his 60-acre all-grass dairy farm in the Department of Seine Inférieure, near Dieppe, and he has farmed with a great deal of enjoyment as well as financial gain.

In his book he deals with the growth and use of grass as fodder for the dairy herd within an intensive system of grassland farming, and he says something really important when he links the dairy cow, the grass crop and the soil into one ecological whole. He stresses the important influence which the animal has upon the sward it grazes. If every farmer were to ponder these thoughts it would engender among graziers a much needed consciousness of the impact of the animal upon the behaviour of the individual grasses and clovers which together constitute our grasslands.

Grassland farming is indeed a practical exercise in ecology, and yet how many farmers can claim to know the meaning of the term "ecology" let alone understand for themselves the simple underlying concepts? Dr. Voisin explains some of these concepts and shows that on his own dairy farm he has gained financially as a consequence of their better understanding.

The exhilarating enthusiasm of Dr. Voisin does, however, tend to make him repetitive, and while this helps to emphasize, it could be irksome to some readers. The book offers answers to some practical questions but poses a host of other related questions which are left unanswered. This is as it should be, if only because we are still, as grassland agronomists, on the threshold of knowledge. This is true not only in France, which is clearly "on the march", but in all other countries.

It is not a little due to the vigour of such men as André Voisin in France that that country is quickly developing a grassland consciousness which was completely lacking two decades ago. The book is excellently produced, almost lavishly so, and the translation is well done, although a few errors have been allowed to creep in.

W.D.

Royal Botanic Gardens, Kew. W. B. TURRILL. Herbert Jenkins. 25*s*.

The beginnings of the modern Royal Botanic Gardens at Kew were made in 1759 by that remarkable lady, Princess Augusta of Saxe-Gotha, mother of George III. She had as her helpers the Earl of Bute, Sir William Chambers, the architect, and later on Sir Joseph Banks. Between them they created what was to be the first truly botanical garden—a garden in which plants were grown for their own sakes and not for any medicinal virtue they might possess or because of the odour or beauty of their flowers.

After the Gardens became public property in 1841, in which year a scientist, Sir William Hooker, was appointed as Director, the foundations of what was to become the greatest scientific institution of its kind in the world, were laid.

The history of Kew Gardens makes fascinating reading, and it is well told in this book by Dr. W. B. Turrill. Its publication just now is particularly appropriate since the bicentenary was celebrated in June. It also brings up to date the voluminous literature in prose (and some second-rate poetry) which has been written on Kew and its beauty.

Dr. Turrill is exceptionally well qualified to have written such a book, for this year he completes fifty years at Kew, of which all but one were spent as a member of the scientific staff, finally ending his service as Keeper of the Herbarium and Library.

His book is not only a factual history of the development that has taken place in the Gardens from their earliest beginnings to the present day, but is also an exhaustive and detailed guide to the plants which are grown in the open and under glass, as well as to the buildings and objects of an ornamental nature which are to be met with. Moreover he makes clear what is done by the scientific staff (the "back-room boys", to descend to the nadir of popular journalism) behind the scenes, the most important work of the institution, and what its significance is in the world of botanical science.

It is well that the public who visit the Gardens in their thousands to enjoy, in exchange for a modest threepence, a peace and quietness which are so hard to find in the hurry and bustle of our modern life, should know this.

The book is well written, well documented, well illustrated, well got up, and altogether most modestly priced at 25*s*.

K.B.

The Biological Productivity of Britain. Edited by W. B. Yapp and D. J. Watson. Institute of Biology. 25*s*.

A wide range of interests was covered at a symposium arranged by the Institute of Biology in the autumn of 1957; the papers presented, and the discussions which followed, have been published in this volume. Two were geographical in nature, dealing with problems of land utilization, and three were by agriculturists and covered the industry in general, plant breeding and animal husbandry. One paper was strictly botanical and concentrated on factors limiting production, whilst the remainder dealt with forestry, fish and water supply. The final paper was a most stimulating one entitled "Unconventional Production of Foodstuffs".

It will be seen that the symposium was a mixture of pure and applied sciences, and is best described as an occasion for "thinking aloud"—a very desirable process for both parties. To the agriculturist, productivity is inevitably mixed up with economics, but the suggestions put forward by some scientists during the discussion bordered on the farcical. Thus, the proposal was made, probably quite seriously, that breeders should try to produce animals as near spherical as possible, on the basis that the area of skin in relation to live weight would make them much more efficient as converters of food.

The pure biologist is able to speculate about all kinds of possible methods of increasing productivity, without worrying too much about economics. That is the province of the applied scientist who may, after suitable modification, be able to put the ideas into practice. Thus, with photosynthesis as the basis of all plant production, it was argued that an increase in the concentration of CO_2 in the atmosphere might lead to an increase in the rate of photosynthesis. This has been successfully applied in some experimental glasshouses, though not without some danger of the leaves developing necrosis.

It is not easy in a short review to give this volume its full merit, but it can be strongly recommended to anyone who is looking ahead and trying to visualize how the human race is to be fed during the next two or three hundred years.

R.E.

Fertilizers for the Farm and Garden. L. J. H. Teakle and R. A. Boyle. Angus and Robertson. 63*s*.

Under this modest title, which might almost suggest a tabloid publication, the authors have presented a formidable array of facts about the development and present position of fertilizers in Australia. Professor Teakle worked for many years in agricultural research in Western Australia before becoming Professor of Agriculture in the University of Queensland; and his co-author, Mr. R. A. Boyle, is a well-known figure in the fertilizer world. Between them they have covered a wide field very thoroughly.

After a short historical introduction there are chapters dealing with the basic relationships between soil and plants and the various methods of assessing the

nutrient requirements of soils, particularly by field experimentation. In this connection modern statistical methods have reinforced the simpler trials that were adequate to reveal acute deficiencies. As in England, it is the sugar industry which has been most active in calibrating its methods of soil analysis against the findings of field experiments, with the result that systems of manuring which involve only a few standard mixtures have been adopted.

The chapter on the manufacture and properties of the fertilizers, including a brief mention of some of the lesser-known materials, is well done. Without going into unnecessary detail a very good idea of the essential steps in the technical processes is given. The transformations and absorptions that most fertilizers undergo when mixed with the soil, and their effects on soil reaction, are followed out in some detail; but farmer readers who have left their chemistry far behind will probably take some of this for granted. From this point onwards the book has much to say to practical farmers. There is a long review, with numerous yield tables, of selected fertilizer experiments covering a very wide range of soils and crops, to say nothing of rainfall areas. The authors do not read too much into these results, and they admit that there are many experiments on record that show limited benefit from fertilizers, but those quoted are presented for the general guidance of farmers and as a stimulus for further work.

Following this is a survey of fertilizer usage in Australia, the information being classified by nutrients, including minor elements, then by crops on a regional basis. The book ends with a comprehensive set of recommendations for grassland, farm crops, fruit and vegetables. The authors point out that fertilizer requirements change with farming standards and experimental work must continue to fill in the finer details.

The general impression conveyed is of an almost universal phosphate shortage that can often be met by quite small doses of superphosphate. It is expected that nitrogen and potassium, already used in the more intensive areas, will gradually gain ground as the demands on the soils increase.

There are numerous references to fertilizer papers, mostly from Australian sources, and a comprehensive bibliography.

H.V.G.

General Microbiology. R. Y. Stanier, M. Doudoroff and E. A. Adelberg. Macmillan (New York and London). 50*s*.

The authors of this book have given a vivid and stimulating account of the micro-organisms, in which instead of following the standard text-book pattern of the systematic survey, they have asked the question "Come tell me how you live . . . and what it is you do".

The first chapters give a brief history of the development of microbiology as a science. Then follows a survey of the main groups of micro-organisms, the algae, fungi, protozoa, bacteria and blue-green algae, which is presented in a most unusual and attractive manner. Bacteria, viruses and Rickettsiae are given especially full treatment. A beautifully illustrated chapter on the anatomy of the bacterial cell gives a well-balanced and undogmatic account of recent work and, as in many other parts of the book, relates the subject under discussion to the whole biology of the organisms.

As might be expected, the largest section of the book deals with microbial physiology, and includes special chapters on respiration and photosynthesis, mineral nutrition and the influence of environment on growth and death. Much of the discussion on metabolism is pure biochemistry and contains excellent accounts of electron and energy transfer mechanisms. Simple and well-constructed diagrams make the presentation of these chapters very clear.

So much research is at present being carried out on the genetics of micro-organisms that it is a pity the authors have found space for only two chapters on this subject. These are, however, masterpieces of writing, giving the results of important experiments and something of the excitement of a rapidly developing field.

A substantial part of the book is subtitled "The Ecology of Micro-organisms", and in this all the artificial distinctions between medical, veterinary, plant, soil and industrial microbiology disappear. Instead the biology of micro-organisms is discussed under such general headings as "Micro-organisms as Geochemical Agents", "Symbiotic Relations of Micro-organisms to Plants and Animals", "The Nature of Parasitism", "The Dynamics of Disease in Populations".

This work is written for the university student rather than the research worker. It should, however, have an appeal to many who want a clear and readable

account of the work of the microbiologist. The authors have written an appendix entitled "The Biological Background", which introduces the biological concepts necessary for a chemist, and also a number of biochemical concepts which may be needed by a biologist.

There is no bibliography, only a short list of further reading. This is unfortunate, but apart from this criticism, it is hard to find fault with the book. Among its special merits, the style of writing is remarkably high for a science text-book, and illustrations and diagrams are well chosen and reproduced.

J.L.H.

American Agriculture: Geography, Resources, Conservation. EDWARD HIGBEE. Chapman and Hall (London), Wiley (New York). 64*s*.

One part of this book deals with the western half of the United States, and the other the humid eastern half. It opens with a useful introduction to the principles governing the relation between climate, soil types, natural vegetation and agriculture; and then goes straight to the central agricultural problem of the western States; namely, water shortage. The writer shows how forest-grazing and range-management on the western hills and mountains influences the water supply of the highly productive and mechanized irrigated areas in the valleys. For water storage, flood control, and the prevention of the silting up of lowland irrigation works depend, in part, on proper action in the highlands to conserve soil and water, to maintain forests, and to avoid over-grazing.

In an arid area, the successful and integrated use of land and water calls for bold, imaginative planning, and for more interference with local and personal rights than is sometimes readily acceptable. Professor Higbee, therefore, touches briefly on some of these political issues. He then takes a look at the humid Pacific north-west; his study of the Willamette Valley of Oregon is of special interest to us, because it has some resemblance to south and east England.

In the dry Great Plains, livestock ranching and extensive systems of wheat growing are found. The unreliability of the very limited rainfall is reflected in government-sponsored crop insurance schemes, and in the number of grain farmers who have other interests in local towns ("sidewalk farmers") or in farms in other parts of the country ("suitcase farmers").

Latitude, altitude, drainage, varying soil types, and other factors familiar to us play bigger farming roles in the eastern than in the western part of the United States. This adds interest to the author's study of the main types of farming regions in the humid east, particularly as he includes case studies of farms where the soil and water conservation practices are good. His review covers the Corn (maize), Dairy and Cotton "Belts", as well as localized and specialized types of land use ranging from citrus, rice and peanuts in the south, through the tobacco country to market gardening and cranberry bogs in the north.

The book is full of useful information and is well illustrated, though some of the maps are too small to be read easily. It is a pity, however, that Professor Higbee provides no conclusions. As he is Professor of Geography and Agricultural Economics in the University of Delaware, and takes an obvious interest in land and water conservation, a summary of his views on the ecological and economic principles governing the geography of American agriculture would surely have been both helpful and welcome.

A.N.D.

The Rose in Britain. N. P. HARVEY. Souvenir Press. 25*s*.

In 1951 I wrote that "I have no hesitation in ranking *The Rose in Britain* as one of the most outstanding contributions to horticultural literature which 1951 has produced". One might say the same thing in 1959, because the author has laboured assiduously to bring his book up to date, and to make it a standard work on the subject. It is nice to handle, and has twenty-two really beautiful coloured plates. The rose, as I know full well, is not an easy flower to illustrate in colour, but Mr. Harvey has managed to choose originals that have reproduced well, and give his book an air of distinction.

The text, I am glad to say, matches the distinction of the illustrations. It follows what has almost become the standard treatment for specialist books—a history, chapters on the different types, a dissertation on fragrance (and here, of course, the evidence disproves the widely-held belief that modern roses have no scent, as many of them have all the scent we could wish).

Then Mr. Harvey takes us through the diseases, pests and the propagation of roses, and eventually comes to what I feel is the most valuable part of his book. He sets out selections of roses for many purposes—for example: hybrid tea varieties for general garden cultivation; resistant to rain; and, what is more important, those that are susceptible to rain and should be avoided if one is, as I am, pessimistic enough to believe that we shall have more wet summers than dry ones.

Following this are eighty-eight pages under the heading "A Glossary of Roses". This is an alphabetical list of varieties at present in cultivation, setting out their origins, possibilities, and limitations. The book ends with a chapter on "The Future of the Rose", which holds out glorious possibilities, tempered of course with the knowledge that rose breeding is a long and tedious business fraught with many disappointments.

No one can read this book without being inspired to grow more roses and to watch future developments with an eagle eye. The rose certainly is not losing ground in Britain, and Mr. Harvey's book will undoubtedly stimulate many gardeners to grow more and better roses than they have done in the past.

R.H.

This Mushroom Business. FRED C. ATKINS. Faber and Faber. 18*s*.

At the end of the second world war the mushroom industry found itself in the doldrums. But during the past twelve years growers have been organized on a national, indeed international, scale under the aegis of the Mushroom Growers' Association. As the industry tackles modern problems, co-operation is the rule rather than the exception, with the secrecy and suspicion of pre-war days largely forgotten. Research has been stimulated both privately and at research establishments, and an International Conference on Mushroom Science is held every three years. Much of the credit for this progress must be given to the few far-sighted growers who struggled, and none harder than Mr. Atkins, to establish the Mushroom Research Association at Yaxley. The work of this station has been taken over and extended by the Glasshouse Crops Research Institute. The year 1957 saw an explosive expansion of production, undoubtedly a result of the developments during the post-war period, but in its train has come a slump in prices which is forcing the industry to re-assess its economy.

Mr. Atkins, believing that the end of an era has been reached, has collected and collated letters and articles written during this period as a modest historical record of the problems which faced the industry. There is no doubt that the author is well qualified to present this record, for there cannot be many important events, affecting the industry since the war, with which he has not been intimately concerned.

His account of the recent developments in the industry should be of considerable interest both to established and new, or intending, growers. The former will find much of value and interest, not only in relation to past events but for the future. The latter will be left in no doubt as to the difficulties which they will almost certainly experience but, after reading this book, they will be better equipped to face them. His emphasis on the fact that spawns now grow twice as fast as they did only ten years ago calls attention to a most important aspect of pathological research in the field of pests and diseases. Although this book is a collation of previously published writings and is disjointed in places, it is none the less well written and easy to read. As an account of the struggles of a small, but dynamic, industry it should also be of interest to readers with no connection with mushroom growing.

Altogether a most useful addition to the "mushroom" library.

N.W.H.

Chinchilla Breeding. C. F. SNOW. W. and G. Foyle. 3*s*.

It is fortunate that, when chinchillas are being widely advertised and interest in these animals has been aroused, Mr. Snow's book should appear and prove so readable and practical. It is well planned; the reader is taken through the history of the chinchilla's domestication and on through chapters on housing, feeding and management, which are redolent of experience and full of practical advice.

Breeding has a full chapter and contains many tips for the would-be breeder, but it may tend to suggest a better reproduction rate than is generally found in practice, namely a litter average of 1·7

and litters of one, two and three in that order of frequency. The chapter on pelting is very detailed, and would be easier to follow with the aid of photographs or even good line drawings. Diseases that may affect young and adult chinchillas are briefly dealt with, and the breeder is wisely counselled to call in a veterinary surgeon for the more serious conditions.

The last two chapters, "Selling and buying" and "Costs and prospects", are the most controversial at a time when the industry is still in the phase of livestock expansion and there is little trade in pelts. The author's plain statement that it is not a get-rich-quick business is unfortunately rather offset by the reference in the foreword to £20 per pelt. This figure is not a true reflection of the state of the fur trade and is more an index of what may be paid for a small proportion of really good pelts coming forward among many more of lower quality. It might have been wise to stress that an increase in the number of good-quality pelts is likely to lower prices, which at present reflect a scarcity value. The ultimate arbiter in fur farming is that most fickle of all mistresses, Fashion, aided and abetted by the fashion designers.

The illustrations are good: some of them are shown in connection with an article on p. 182 in this issue. The print is clear and easy on the eye.

W.M.A.

Miniature Trees and Shrubs. ANNE ASHBERRY. N. Kaye. 25*s*.

Most people on picking up this book would expect to find information on the amazing stunted trees of immense age produced by the Japanese *Bonsai* methods of root pruning, starvation and the withholding of water.

They will be pleasantly surprised, for the trees and shrubs dealt with do not become dwarfs because of the deprivation of life's necessities and barbaric treatment, but merely because it is their nature—in other words, their genetical "make-up"—to live as dwarfs.

The book is divided into four parts: dwarf conifers, dwarf roses, dwarf shrubs other than roses and a chapter on the care of these subjects. By far the largest part is taken up by an account of the dwarf conifers so eminently suited for trough gardens, window gardens or even for pot culture. Here will be found much detailed information about the origin of the various forms, their identification, propagation and so forth. The chapters on the dicotyledonous species are equally informative and instructive.

Half-tone blocks and line drawings lavishly illustrate this book. The half-tones are mostly excellent, though not always of equal merit. Miss Grein Clegg's line drawings are of rare delicacy and add much to the value of the book.

Miss Ashberry is to be congratulated upon a notable addition to gardening literature, and the publishers no less on the production of this most attractive volume at the very reasonable figure of twenty-five shillings.

K.B.

Agricultural Hydraulic Engineering. G. SCHROEDER. Springer-Verlag, Berlin. DM 54.

Here is a comprehensive text-book on agricultural hydraulic engineering, although its usefulness to English readers is restricted by the fact that the text is in German, without any English summaries or other aids. The book contains a wealth of information covering the whole engineering field of land drainage and irrigation, and the subject is dealt with from a practical, technical aspect in a very compact manner: in just over 500 pages there are some 200 tables of data and 370 line diagrams and graphs. Theory is discussed only so far as it is necessary to appreciate the technical aspect.

The matter follows a logical sequence, with first a discussion of the basic factors affecting drainage and irrigation, such as soil and plant science, soil moisture and weather science. Then follow sections dealing with arterial and field drainage works, including the choice and operation of the appropriate plant and machinery. Surface, underground and spray irrigation are similarly covered from the engineering angle, and at the end of the book there are two sections dealing with the special problems of marshland agriculture and land reclamation.

The book deals almost exclusively with German conditions and knowledge, there being little reference to American or Western European experience. It is, however, a worthwhile book for libraries and those to whom the German language presents no difficulties.

G.H.T.

The Small Farms of Industrial Yorkshire. Leeds University. 3*s*.

The publication of this survey, which examines the historical, social and economic background of small farms in a hill area of Yorkshire (where agriculture is interspersed with industry), coincides most opportunely with the launching of the Ministry's Small Farmer Scheme. Its findings cannot, however, be related to the small farm problem as a whole, since the locality under review probably has no precise counterpart anywhere else in the country.

Those concerned with this publication have had considerable experience of the economics, based on annual costings of farm enterprises, of this and other areas of Yorkshire. They have attempted to find a reason for the establishment of so many small farms in the area by delving into its history, and examining the social conditions which might explain why so many farmers still try to make a most frugal living under very difficult conditions.

Many tables are provided to support the text, which in itself is a mass of information; such as, 75 per cent of the farmers were bred and born in the area and 80 per cent had always been farmers or farm workers. This not only shows the detail with which the work has been concerned, but goes a long way to explain the present make-up of the agricultural population.

The economic survey deals mainly with milk production, which is the most important single enterprise, augmented, as one would expect, by pigs and poultry. The conclusion reached is that the prospects are not bright, and suggestions are made as to how the farmers can help themselves or be helped by changes in agricultural policy. These range from pensioning off the farmers and re-planning the area with farms of an economic size, through the vexed question of amalgamation, to the more realistic suggestion of improving output by technical advice, to which the writers say the farmers are not averse.

There is a great deal more than can be pin-pointed in a brief review, and anyone concerned in this very real problem of the small farm will find much of interest in the book, as indeed will any student of sociology. *J.T.*

Electricity for the Grower. Electrical Development Association.

This is the first comprehensive guide to the many benefits electricity can bring to commercial horticulturists.

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Electricity for the Grower describes how all these benefits, and many others, may be obtained. It is available free, from Electricity Boards or from the Electrical Development Association, 2 Savoy Hill, London, W.C.2.

Books Received

Potassium Symposium, 1957. This volume contains the sixteen papers read at the fourth Congress of the International Potash Institute which was held in Vienna. The book is obtainable from the Institute, P.O. Box Berne Transit, Switzerland, price Sw. fr. 20. - - .

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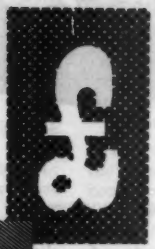

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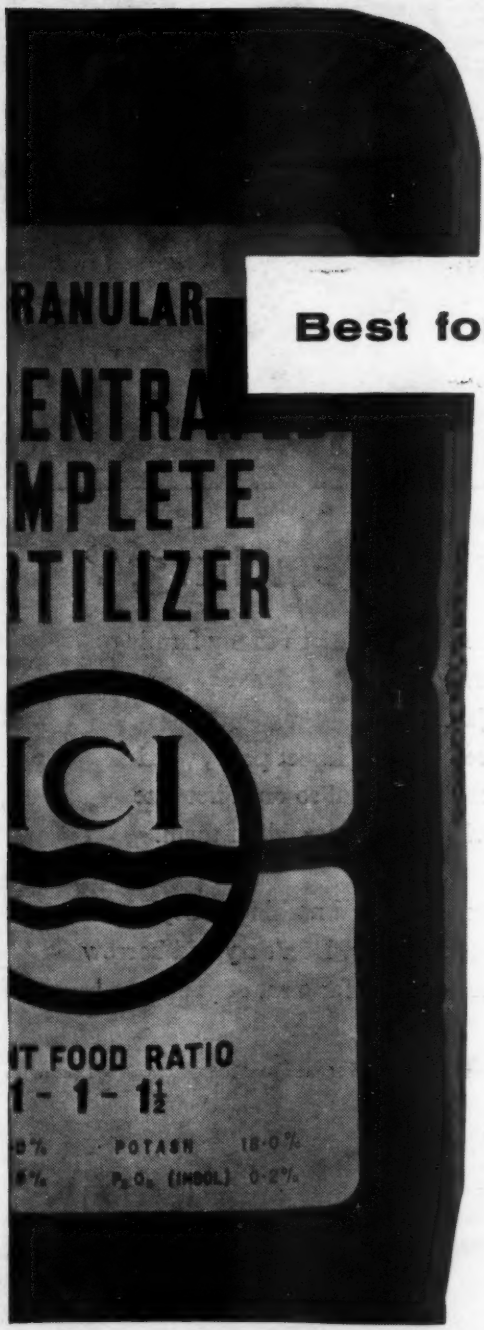

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